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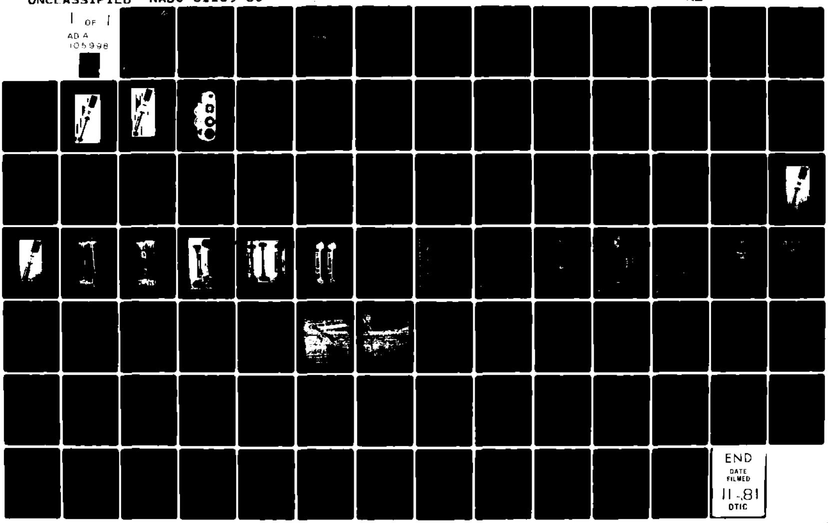

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ENGINEERING DEVELOPMENT OF SINGLE LAUNCH DWARF SONOBUOY LAUNCHER SYSTEMS NADC 60613 DESIGNS

R. Pasquarella, F. Perry, A. Boyd and D. Agnew
Aircraft and Crew Systems Technology Directorate
NAVAL AIR DEVELOPMENT CENTER
Warminster, Pennsylvania 18974

24 June 1981

FINAL REPORT
AIRTASK NO. A3705490/001D/1W0495AS02
Work Unit W0495

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NAVAL AIR SYSTEMS COMMAND
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REPORT DOCUMENTATION PAGE		READ INSTRUCTIONS BEFORE COMPLETING FORM
1. REPORT NUMBER 14 NADC-81139-60	2. GOVT ACCESSION NO. AD-A105998	3. RECIPIENT'S CATALOG NUMBER
4. TITLE (and Subtitle) ENGINEERING DEVELOPMENT OF SINGLE LAUNCH DWARF SONOBUOY LAUNCHER SYSTEMS - NADC 60613 DESIGNS		5. TYPE OF REPORT & PERIOD COVERED Final Report
		6. PERFORMING ORG. REPORT NUMBER
7. AUTHOR(s) R./Pasquarella, F./Perry, A./Boyd ~~and~~ D. Agnew		8. CONTRACT OR GRANT NUMBER(s)
9. PERFORMING ORGANIZATION NAME AND ADDRESS Naval Air Development Center Aircraft and Crew Systems Technology Directorate Warminster, Pennsylvania 18974		10. PROGRAM ELEMENT, PROJECT, TASK AREA & WORK UNIT NUMBERS AIRTASK A3705490/001D/1W0495 AS02; Work Unit W0495
11. CONTROLLING OFFICE NAME AND ADDRESS Naval Air Systems Command (AIR-250) Department of the Navy Washington, DC 20361		12. REPORT DATE 24 June 1981
		13. NUMBER OF PAGES 92
14. MONITORING AGENCY NAME & ADDRESS (if different from Controlling Office)		15. SECURITY CLASS. (of this report) Unclassified
		15a. DECLASSIFICATION/DOWNGRADING SCHEDULE

16. DISTRIBUTION STATEMENT (of this Report)

Approved for Public Release; distribution unlimited

17. DISTRIBUTION STATEMENT (of the abstract entered in Block 20, if different from Report)

18. SUPPLEMENTARY NOTES

19. KEY WORDS (Continue on reverse side if necessary and identify by block number)

Dwarf Sonobuoy, SLC, Sonobuoy, Deployment, CADs, Launcher

20. ABSTRACT (Continue on reverse side if necessary and identify by block number)

This report documents the engineering effort implemented in the production design of a single launch dwarf sonobuoy launcher system that is operational in current deployment aircraft, without requiring retrofit of either on-board deployment equipment or airframe.

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TASK ASSIGNMENT

Advancements in microminaturization of avionics has resulted in the development of a "dwarf" sonobuoy, one third the length of the "A" size configuration (36 + 0.125/-0.1875 inches); the diameter (4.875 + 0/-0.125 inches) remaining constant. In support of this accomplishment, the task of developing the production design of a Single Launch Dwarf Sonobuoy Launcher System (SL/DSLC) has been directed to this command. Three design parameters were specified with the task assignment:

First, the system must utilize a Cartridge Activator Device (CAD) for fire power.

Second, the system must enable dwarf sonobuoy deployment from current deployment aircraft without retrofit of their on-board "A" size deployment equipment and/or the aircraft's airframe.

Third, that the deployment aircrafts to be interfaced with include the P3C, S3A, LAMPS Mark I, LAMPS Mark III, and with the use of the TACAIR POD, the A6 and A7.

On an independent basis, two codes were tasked under reference (a) with this assignment, Naval Air Development Center (NADC) 60613 (Materials Engineering Section, Aero Materials Laboratory, Aircraft and Crew Systems Technology Directorate (ACSTD) and NADC 6013 (Aero Mechanics Design Branch, Design Integration Division, ACSTD). This report documents, in summary form, the NADC 60613 effort, and its results. The 6013 effort is reported under reference (b).

APPROACH

The initial effort implemented in this task assignment was a system design study and analysis, to identify a system design concept that would be compatible with NAVAIR (AIR-250) design parameters, be viable and cost effective. Within a short time, two alternatives became evident, each requiring containment of the dwarf sonobuoy in a Dwarf Sonobuoy Launcher Container (DSLC). One approach, see Figure 1, was connecting a DSLC (housing the dwarf sonobuoy) with an "extender", with a CAD protruding from the end opposite the DSLC, for interface with the breech in the "A" size launch chute in the deployment aircraft. The other possibility, Figure 2, was positioning the CAD in the breech of the DSLC utilizing an "extender" with a cable housed in it, to connect the CAD with a "CAD shaped projection" at the opposite end, that could be inserted into the breech of the "A" size launch chute in a deployment aircraft. The system with the CAD located in the extender at the launch chute's breech end was identified as the "Top Firing" Single Launch Dwarf Sonobuoy Luancher System (TF-SL/DSLS); the other, the "Bottom Firing" (BF-SL/DSLS). A trade off analysis followed the preceeding effort in an attempt to determine which design would be of least risk and the most efficient, in fleet operations.

It was decided that both design concepts had merit, were feasible, practical, and cost effective, and that choice of using one or both would require fleet/user input. The design of both the top and firing were therefore given the go-ahead, with the choice of use of one design or both for fleet operations resulting from a forthcoming fleet decision, based on performance on post-first article fleet evaluations.

PROTOTYPE DEVELOPMENT

SYSTEM DESIGNS

Prototypes of both the top firing and bottom firing systems, developed by NADC 60613, are illustrated by Figures 1 and 2, each consisting of a DSLC and a DSLC extender. In both systems, a polyethylene cushion, positioned at the DSLC end of the extender (Figure 3), provides a vibration/shock absorber and in the case of the top firing is utilized as a gas seal. The top firing system has a "lug locking" design built into the breech and muzzle end of its extender, enabling the extender to be locked into the DSLC, and then as a total system, locked into the launch chute of a deployment aircraft by the conventional aircraft latch detent. The bottom firing system is designed with a dual locking rod system. It can be used to lock the extender to the DSLC, for insertion of the two as a system, and then into the launch chute; or the extender can be inserted and locked into a launch chute by itself with the DSLC inserted into the chute and assembled to the extender as a second step in the installation process. With both these systems, the extender has the capability of being fired 100 times.

The top firing system (Figure 1) enables dwarf sonobuoy launching from all current deployment aircraft and the TACAIR Pod, without retrofit of on-board launching equipment and/or airframe. When the TF-SL/DSLS is used in the LAMPS Mark III, which houses a pneumatic launch equipment system, the CAD must be removed from the DSLC extender breech header. Pressurized air is then allowed to move through the extender's breech header, tube, and muzzle header, through the DSLC's breech header, to discharge the encapsulated dwarf sonobuoy from the DSLC.

The bottom firing (Figure 2) enables the same capability with all current deployment aircraft as does the top firing, with exception of the LAMPS Mark III. As is illustrated by Figure 2, the CAD in this design is inserted into the breech header of the DSLC, not the breech header of the extender. Discharge from the CAD impinges directly onto the top of the dwarf sonobuoy, and does not go through the extender. The electrical impulse that detonates the CAD comes down through the extender tube through a cable, from a "CAD shaped" protrusion projecting out from the extender's breech header, which inserts into the "A" size launch chute CAD receptacle in the aircraft. The "CAD shaped" protrusion in the BF-SL/DSLS extender's breech header is not removable, as is the CAD in the top firing system. As a result, the bottom firing system is not adaptable to the LAMPS Mark III launch equipment system. With additional engineering time and effort, it may be possible that this lack of interface with the LAMPS Mark III could be eliminated.

Dwarf sonobuoy deployment with a top firing launcher system requires a four step reloading operation. The total system, extender and empty DSLC, must be removed from the aircraft launch chute. The discharged CAD in the extender's breech header must be replaced with a new one. The emptied DSLC must be detached from the extender and replaced with a dwarf sonobuoy loaded DSLC. The combined extender/DSLC assembly or system is then loaded into the launch chute of the deployment aircraft. The bottom firing launcher system requires a two step operation after the extender has been installed and locked into the aircraft launch chute. It stays in place for the one hundred launch life. The two step operation consists of removing the discharged DSLC and replacing it with a fresh CAD and dwarf sonobuoy loaded DSLC.

PROTOTYPE SAMPLES

Ten prototype samples of each system design, top and bottom firing, were machined and assembled in the NADC Model Shop, two of each of five candidate materials. The materials included ABS (Acrylonitrile-Butadiene-Styrene), CB (Cellulose-Butyrate), Noryl, HDPE (High Density Polyethylene), and nylon. Though ABS was considered the prime material for production as well as prototype systems based on past experiences, the decision was made that selection based on actual ground and flight test results was worth the additional effort and cost. Alternative material candidate selection was based on an in depth material survey and evaluation. A copy of the report on this study is included in this report as Appendix A.

As illustrated by Figure 1, the top firing prototype system is an assembly of an extender and a DSLC. The extender is an assembly of two headers, a breech and a muzzle header, connected with an extender tube. The DSLC is an assembly of the breech of a LAU-104/A and a muzzle end of a LAU-111/A SLC. As described previously, when the CAD installed in the breech header is detonated, gas flows through the extender tube, the extender muzzle header, and then the DSLC breech header, on to the breech end of the DSLC encapsulated dwarf sonobuoy, to deployment. A polyethylene foam cushion attached to an extension of the extender tube provides the gas seal between the extender's muzzle header and the DSLC's breech header. The conical foam cushion is also used as a compression spring for the lug locking design built into the extender muzzle header/DSLC breech header interface.

The bottom firing system, illustrated by Figure 2, is also an extender/DSLC assembly, however, not as simplified as the top firing system. The bottom firing extender is an assembly of a breech header with a CAD shaped protrusion that interfaces with the CAD receptacle in the breech of an aircraft "A" size launch chute, an extender tube, a muzzle header with a CAD receptacle in it to receive the CAD positioned in the breech header of the DSLC (for bottom firing discharge), a dual locking rod assembly, an extender handle used to house the dual rod locking assembly, and a cable assembly housed in the extender tube, electrically connecting the breech end of the extender with the CAD receptacle in the muzzle header. A polyethylene foam cushion secured in the muzzle header of the extender, is used to promote alignment in the assembly of the extender and DSLC, and absorb environmental shock and vibration during system storage, loading, unloading, and launch firings.

In developing the drawings from which the prototypes components were machined and assembled, every effort was made to make them as clear and as comprehensive as possible, not only for model shop effort alone, but also to minimize the effort that would be required to produce production drawings further along in the program. Appendix B lists the drawings used to design, machine, and assemble both the top and bottom firing prototype systems, and prototype refurbishing kit components.

TEST PLAN AND RESULTS

The test plan developed for prototype testing was designed and implemented with three objectives in mind: to test the integrity of the top and bottom system designs on an individual basis; to compare the two systems on a reliability and operability basis; and third, to acquire data on the durability of the system as a function of the candidate materials used to make them. The following tests were included in the test plan to accomplish these objectives:

- A form and fit test in the launcher equipment of each of the current deployment aircraft, except the bottom firing system in the LAMPS Mark III (the system and the launcher equipment do not interface, as explained previously in the System Design section).
- Ground firings at ambient, $-65 \pm 2^{\circ}F$, and $160 \pm 2^{\circ}F$.
- Ground shock, vibration, and impact tests.
- Discharge force analysis.
- Flight test firings from the P3C, S3A, and LAMPS Mark I and III.

The following facilities were used in implementing the test plan: NADC, Warminster; NWSC, Crane, Indiana; NOS, Indian Head, Maryland; Sikorsky Aircraft Company, Stratford, Connecticut; NAS, Lakehurst, New Jersey; and NADC, Kev West, Florida.

The bottom line results of the testing effort were that both systems are viable, are reliable, and have different operational advantages, and that ABS is the material to be specified for the production systems. Appendix C documents the test program's test methods, equipment, and results in detail.

PRODUCTION SYSTEMS

SYSTEM DESIGNS

In the development of the production system designs of both the top and bottom firing systems, full advantage was taken of the fact that interface with existing parts and their dimensions, used to make the prototypes was not a design parameter. As a result, the following design improvements were designed into the production versions:

- o All dimensions that are directly involved in interface between the DSLS's and the breech and muzzle ends of the launch chutes of deployment aircraft, in which they are loaded, as well as interface between the DSLC and the DSLC extender, were carefully analyzed and then restructured dimensionally and tolerance wise, optimizing the real world interface relationship, and compliance with reference (c) requirements.

- o The top firing DSLC extender was designed a two part assembly (extender and muzzle-end cushion), the prototype being a four part assembly (two headers, an extender tube, and muzzle end cushion); the bottom firing DSLC extender, a two part assembly (extender and muzzle-end cushion), from the prototype's five part assembly (two headers, extender tube, handle and muzzle end cushion).

- o Both DSLC's utilize a one part design compared to the prototypes two part assemblies (a breech header and muzzle end tube section).

- o The bottom firing DSLS prototype cable assembly, used to connect the CAD receptacle in its muzzle header, with the CAD-shaped "protrusion" in the breech header, was replaced with a well designed cable assembly developed, with the assistance of the Raychem Corporation, of Menlo Park, California.

- o ABS was specified as the material of which both extenders and DSLC's, of both top and bottom firing systems, are to be molded.

In the design of the injection molding tooling of the bottom firing system, one other improvement may develop, it being a molded-in CAD receptacle in the muzzle header, in place of Lockheed CAD receptacle, last priced at $108 each.

To provide the most practical injection mold tooling to accomplish an economical and structurally sound system, design reviews are still being conducted with the contractors on the systems assembly technique.

Appendix D lists the drawings of both production system designs and the production designed refurbishing kit. The production design of the bottom firing system was accomplished with twelve drawings; the top firing system, with four; and the refurbishing kit, with seven.

FIRST ARTICLE/POST FIRST ARTICLE CONTRACTS

On 31 December 1980, firm fixed price contracts were let for the manufacture of production injection mold tooling, thirty first article systems, and two hundred and fifty post-first article systems of the NADC 60613 top firing and bottom firing designs, and the NADC 6013 top firing system. Based on price and response to the technical requirements of the IFB, three contracts were let, one to each of three contractors. A contract for the manufacture of injection molding tooling, thirty first article, and two hundred and fifty post-first article of the NADC 60613 top firing DSLS and an NADC 6013 top firing system extenders was let to the O'Sullivan Corporation, Winchester, Virginia. A contract for the same items of the NADC 60613 bottom firing system extender was let to Plastik, Plastics Industry Services, Northridge, California. A contract for the manufacture of injection molding tooling, thirty first articles, and two hundred and fifty post first articles of the NADC 60613 top firing and bottom firing DSLC, and the NADC 6013 top firing DSLC, was let to Manton Industries, Manton, Michigan. Delivery of the first article extenders of the top firing systems (the 60613 and 6013 designs) are scheduled for 19 June 1981; the first article extenders of the 60613 bottom firing system, 29 July 1981; and the first article DSLC's of all three system designs, 19 August 1981. Thirty days after notification of the completion of First Article Tests, delivery of the post-first articles are due for fleet tests. The delivery of the post-first articles is contingent upon whether or not modification to the first article configuration and therefore the injection molding tooling are required based on the results of first article ground and flight tests. References (d), (e) and (f) are the contracts let to the O'Sullivan Corporation, Plastik, Plastic Industry Services, and Manton Industries, respectively.

FIRST ARTICLE GROUND AND FLIGHT TEST PLAN

Ground tests of first articles are scheduled to begin two weeks following delivery of the DSLC's 19 August 1981, from Manton Industries, Manton, Michigan. Within the two weeks between 19 August and 1 September, the inspection of all the delivered first articles, bottom and top firing extenders and DSLC's, will be completed, assembled on a system basis, packaged, and delivered to the performing test facilities. The test facilities that are to participate in the ground test program are NWSC, Crane, Indiana; Dayton T. Brown, Stratford, Connecticut; NOS, Indian Head, Maryland; and NADC, Warminster in accordance with the following task schedule, and Appendix E, Ground Test Plans:

Facility	Assignment	Appendix
NWSC	Inspection, transportation vibration, Artic Group, and Tropic Group, in accordance with test plan (Modified MIL-L-81745A(AS))	E-2, 3, 4, 5, 6, 7, and 8
Dayton T. Brown	Simulated catapault and arresting (shock) tests	E-9, 10, and 11
NOS	$-65 \pm 2^{o}F$ and $+160 \pm 2^{o}F$ ground firings	E-12
NADC	Arrested landing shock, tip over, and ambient ground firings	E-13, and 14

First article ground testing is scheduled for completion by 16 October 1981. The first article flight tests are to begin upon the completion of all ground testing. The first article flight test plan, however, is in the process of development, and is not included in this report. However, it is anticipated that all designs will be launched, in flight, from the P-3C, S-3A, LAMPS I, LAMPS III and TACAIR Pod within a month of successful completion of first article ground test.

POST FIRST ARTICLE FLEET TEST PLAN

Definition and the schedule of tests to be performed in the post-first article fleet test program are in the process of development. At such time that the plan is completed, it will be issued by the NADC/DSLS Project Management Office, NADC Code 3042.

CONCLUSIONS AND RECOMMENDATIONS

There are significant differences in the attributes of both the top and bottom system design concepts. Top firing system prototypes, both the NADC 60613 and NADC 6013 design, and the NADC 60613 bottom firing design have endured extensive ground and flight tests successfully. The only conclusion and recommendation that can be drawn from the effort implemented to date, is that the choice is that of fleet personnel, as to which system or combination of systems will serve their purpose efficiently and cost effectively, based on the results that will be experienced in the fleet test program.

REFERENCES

(a) AIRTASK No. A3705490/001D/1W0495AS02, Dwarf Sonobuoy Development

(b) NADC Report No. NADC-81020-60, Dwarf Sonobuoy Launch Extender - Hybrid Model Development

(c) NADC Drawing No. TE21077, Envelope Control Drawing for "A" Size Store Launch Systems

(d) NADC Contract (N62269-81-C-0238) for the Production Tooling, First Article and Post First Articles of the NADC 60613 and NADC 6013 Top Firing DSLS Extenders with the O'Sullivan Corporation, Winchester, Virginia

(e) NADC Contract (N62269-81-C-0237) for the Production of Tooling, First Articles, and Post First Articles of the NADC 60613 Bottom Firing DSLS Extender, with the Plastik, Plastic Industry Services, Northridge, California

(f) NADC Contract (N62269-81-C-0208) for the Production Tooling, First Article and Post First Articles of the NADC 60613 Top and Bottom Firing, and the NADC 6013 Top Firing DSLC's with Manton Industries, Manton, Michigan

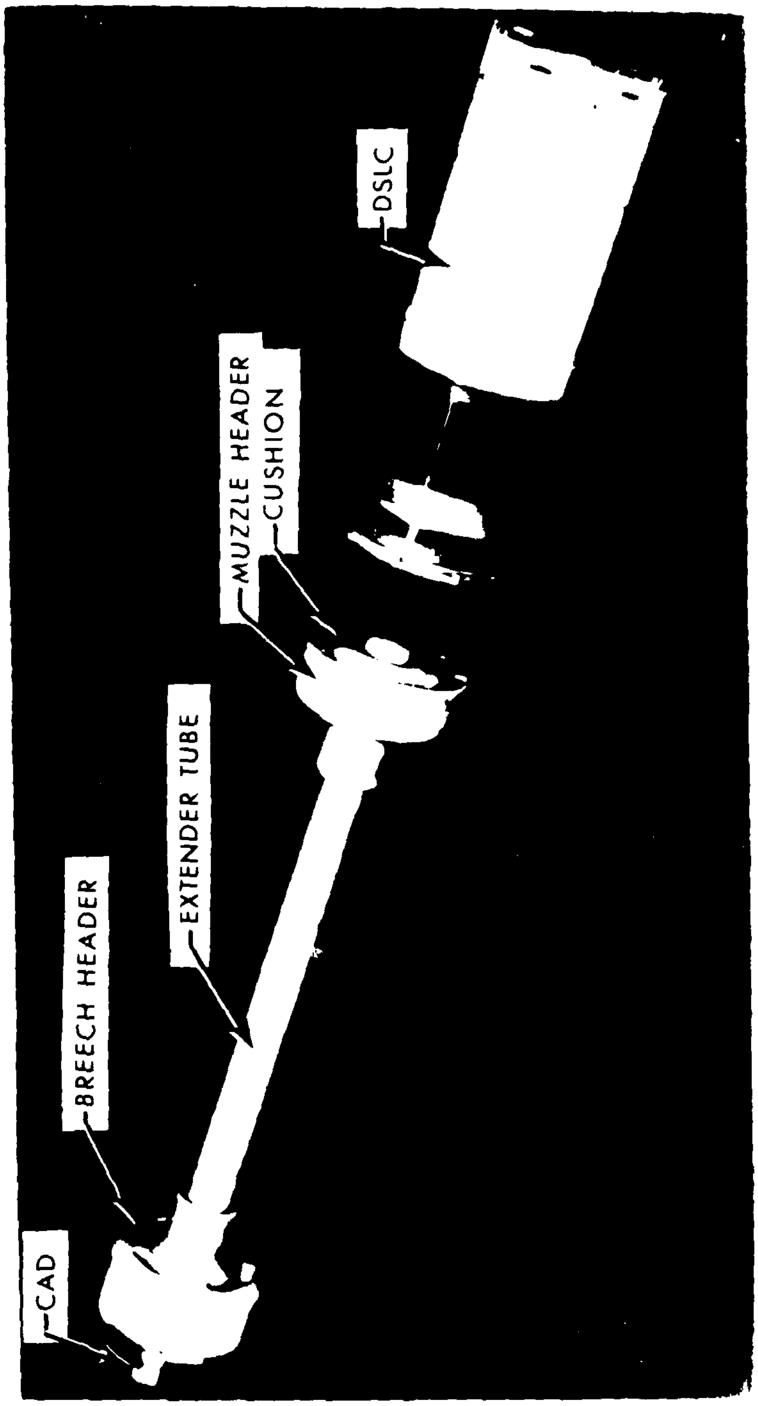

FIGURE 1. NADC 60613 Top Firing-Single Launch/Dwarf Sonobuoy Launcher System (TF-SL/DSLS)

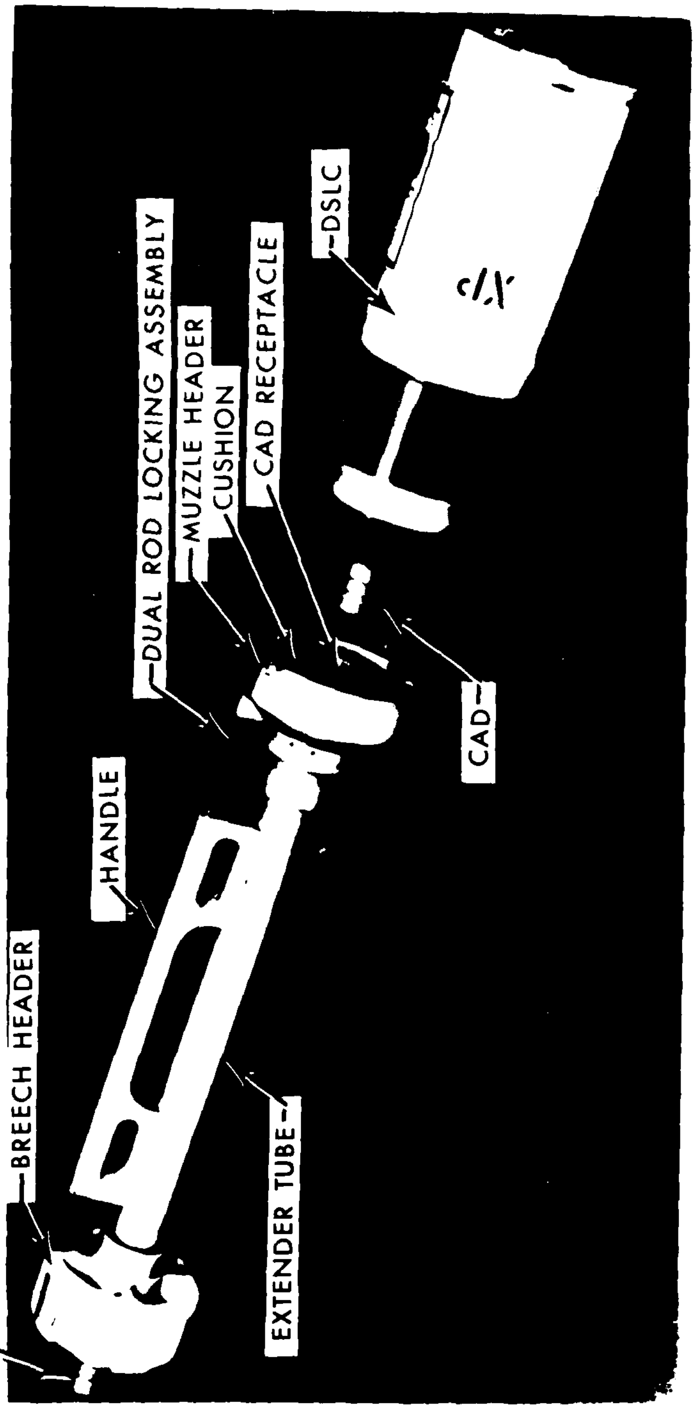

FIGURE 2. NADC 60613 Bottom Firing-Single Launch/Dwarf Sonobuoy Launcher System (BF-SL/DSLS)

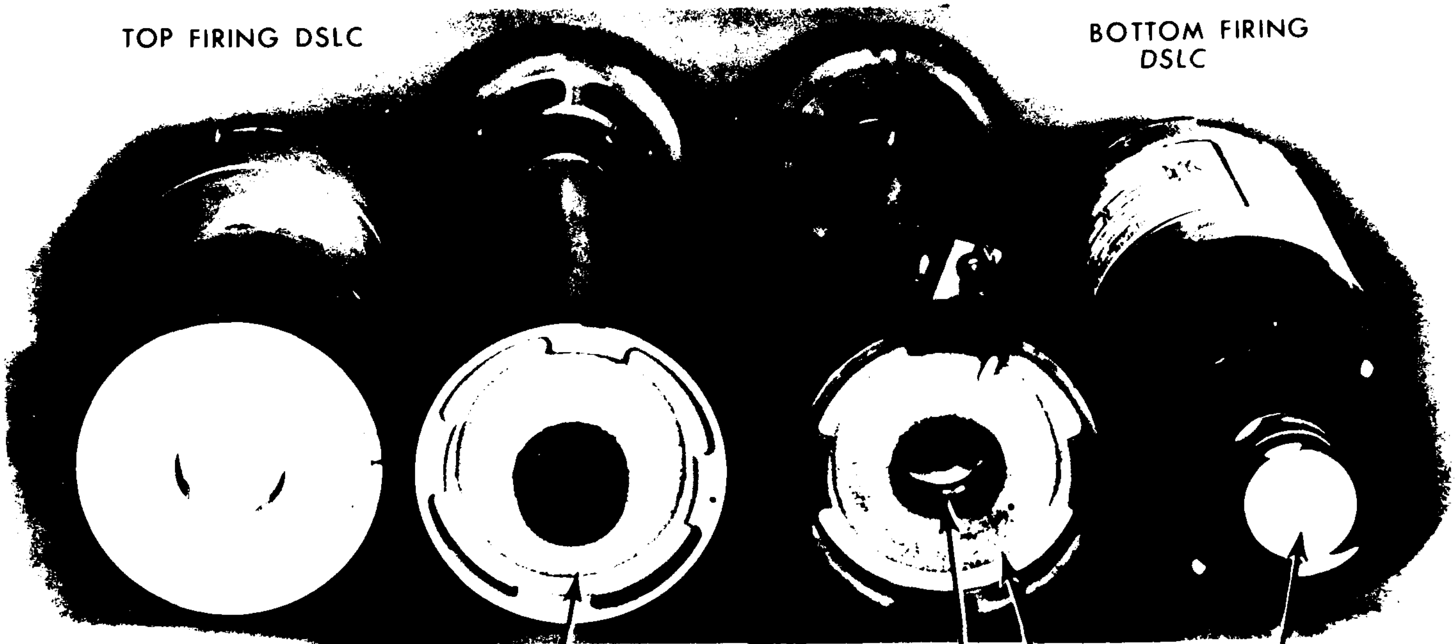

FIGURE 3. NADC 60613 Top and Bottom Firing SL/DSLS Extenders and DSLC(S)

APPENDIX A

WEIGHT/COST ANALYSIS - DWARF LAUNCHER ASSEMBLY
(6061 - 13 MARCH 1980)

NAVAL AIR DEVELOPMENT CENTER
Aircraft and Crew Systems Technology Directorate
Warminster, Pennsylvania 18974

6061
13 Mar 80
Updated 12 May 1981

WEIGHT/COST ANALYSIS - DWARF LAUNCHER ASSEMBLY

1. A weight/cost analysis study has been conducted on the Dwarf launching system which consisted of:

a. Material analysis
b. Material costs
c. Material weight
d. Processing costs
e. Cost of current production parts
f. Past performance

2. The philosophy used in materials selection is to use materials that have performed satisfactorily in the expected environments, or those that have similar or better capabilities. There will be no significant change in the Sonobuoy Launcher Container (SLC) material:

a. Polyethylene cushion rings
b. Polypropylene obturator
c. Acrylonitrile, butadiene, Styrene (ABS) Breakout Cap
d. Polysulfone breakout cap shear pins
e. ABS molded tube assembly

The sonobuoy launcher extender (SLEx) will be manufactured for test evaluation from:

f. ABS
g. Cellulose Butyrate
h. Polyanylene ether
i. Polyethylene
j. Nylon

These materials (f through j) were selected in part based on the physical characteristics depicted in attachment (1). The NADC recommended SLC materials (a through e) have been used successfully for 8 years for launching sonobuoys and no advantage is seen in changing for this program.

3. MIL-L-81745A requires that the SLC weight, less CAD, store and external items, shall not exceed 7 lbs. It is intended to keep the combined SLC and SLEX weight equivalent to the LAU 111/A. In this regard the SLC and SLEx CAD fired at top will be equivalent to LAU 111/A, but because of the additional hardware, the SLC and SLEx CAD fired at bottom the combined weight could be as high as two pounds heavier than the LAU 111/A. However, because of the Dwarf Sonobuoy weight, the whole system will still be at least 5 pounds lighter than a loaded LAU 111/A.

4. As a "rule of thumb" it has been determined that to estimate costs for plastic injection molded launcher assemblies, the material cost should be multiplied by 2.5. As an example, it has been learned that Magnavox pays between $10.50 and $11.25 for the LAU 111/A. A "rule of thumb" estimate by NADC would be $10.63 (4.62 lb x .92 $/lb x 2.5). Using this same technique, the worst case SLC/SLEx (CAD fired at bottom - most expensive material) would be $31.28 and the best case SLC/SLEx (CAD fired at top - less expensive material) would be $9.31. Over the life of the SLEx (100 firings) the cost per shot would be (excluding CAD costs):

a. LAU 111/A - $10.63 - NO
b. Worst case SLC/SLEx - $7.94
c. Best case SLC/SLEx - $6.45

As in the case of the LAU 111/A the cost per unit for the SLC/SLEx combination due to injection mold tooling over the life of the tooling would run between $0.10 and $0.36 per SLC/SLEx combination.

5. A summary of the previous paragraphs is presented as follows:

Configuration	Weight	Cost (Material Dependent)		
		ABS*		Nylon
LAU 111/A (Production	4.62#	$10.63		
Dwarf SLC (Plastic)	2.05#	$ 6.43	-	$7.71
SLEX/CAD Top (Plastic)	2.65#	$2.85	-	$8.88
SLEx/CAD Bottom (Plastic)	4.05#	$14.35	-	$23.57
SLEx/Top (Aluminum)	5.4#	$138.75		

The Dwarf SLC costs were modified from the 2.5 factor because it was found that the ABS tube portion cost approximately $7. Therefore, the breakout cap, obturator, etc. is being priced for this study at $3.63. Adjusting the $7 figure for a shorter length and adding the $3.63 gives the cost for the Dwarf SLC used for this study. Also, the SLEX./CAD Bottom will need additional hardware to funnel aircraft activation pulses and ground through the SLEx to the SLC. The NADC designer has been directed to meet a target cost per unit of $75 to provide the same capability. Therefore, the SLEx/CAD Bottom has a *$75 figure added after applying the 2.5 factor. Aluminum costs are presented for comparison only and no effort will be expended to provide a configuration from aluminum. However, even if aluminum were required a total cost of only $9.10 per firing would result which is cheaper than present A-size. Adding the hardware cost ($75) to the bottom firing cost $31.28 the cost per firing would be $8.70*.

Also, a synopsis on the materials to be evaluated is offered (see attachment for more detail):

* updated 12 May 1981

Material	Reason for Selection	Cost/lb
Acrylonitrile, Butadiene Styrene (ABS)	Past performance	$ 0.92
Cellulose Butyrate	30% to 40% non-petro chemical less tough than ABS	0.97
Polyanylene Ether	Equivalent or tougher than ABS	1.15
Polyethylene	Economical; less tough than ABS	0.43
Nylon	Moderately tougher than ABS	1.34

All material costs are constantly rising

The ABS material has performed successfully in the SLC configuration and because of the latitude for increasing the structural capability allowed by the SLEx/CAD Bottom configuration, the ABS should be more than adequate. This same reasoning, coupled with economics, is why less tougher materials are being considered. In the case of cellulose butyrate, the fact that a percentage of the compound is made from wood derivatives rather than oil makes it an attractive consideration. The use of a tougher material, nylon, could provide a SLEx of a lesser weight.

Some of the materials noted above are strictly for extrusion processes, which is the process needed for the prototype manufacturer. All successful materials will be acquired in injection mold grades for molding of first article test samples.

LABORATORY TEST SHEET

DATE: 12 MARCH 1980 | TEST ENGINEER: F. T. PERRY

PRINCIPAL PROPERTIES - NOMINATED PLASTICS

MANUFACTURER I.D.	MATERIAL	MANUFAC-TURER	LINEAR MOLD SHRINKAGE in/in	TENSIL MODULUS 10^5 PSI	FLEXURAL MODULUS 10^5 PSI	IZOD NOTCH ROOM TEMP. (73°F) Ft/Lb/In	IZOD NOTCH LOW TEMP. (-40°F) Ft/Lb/In	LINEAR THERMAL EXPANSION 10^5 in/in°F	TENSILE STRENGTH BREAK PSI	WATER ABSORPTION % 24 hrs	DEFLECTION TEMP. °F @ 66 PSI	DEFLECTION TEMP. °F @ 264 PSI	COST ¢/lbs LOT SIZE
CYCOLAC GRADE L	ABS	BORG-WARNER	.005/.007	3.6	3.2	7.0	3.0	4.0	7,000	.07	180	190	.92
(Acrylonitrile-Butadiene-Styrene)													
479H3 TENITE	CB	EASTMAN	.005/.007	3.0	2.5	1.3	0.6	110 to 170 X10-6 in/in per °C	5,600	1.8	183	208	.97
(Cellulose Butyrate)													
NORYL N-190-N190		GENERAL ELECTRIC	.007/.009	2.6	2.7	7.5	2.6	2.9	5,000	.066	208 unannealed - 188 / 219 annealed - 210		1.15
(Polyarylene Ether)													
PPO		GENERAL ELECTRIC	NO LONGER	MARKETED -	SHELF LIFE	/ CRACKING	PROBLEM						
(Polyphenylene Oxide)													
#35063 HDPE		DOW	.007/.009	1.8	2.05	6.9	* 1.6	* 11.0	4,100	-.01	170		41/43
(High Density Polyethylene)													
ZYTEL 42	NYLON	DU PONT	.015	2.6/4.0	4.1	1.3		4.5	8,500	1.5	220	470	1.34
(Nylon 6/6)													

* ESTIMATED

Attachment 1

NAD-GEN-112

LABORATORY TEST SHEET

TEST OF

TEST EQUIPMENT: · PRINCIPAL PROPERTIES - NOMINATED PLASTICS

DATE: 12 MARCH 1980

TEST ENGINEER: F. T. PERRY

OBSERVERS

MANUFACTURER I.D.	MATERIAL	MANUFAC-TURER	LINEAR MOLD SHRINKAGE in/in	TENSIL MODULUS 10^5 PSI	FLEXURAL MODULUS 10^5 PSI	IZOD NOTCH ROOM TEMP. (73°F) Ft/Lb/In	IZOD NOTCH LOW TEMP. (-40°F) Ft/Lb/In	LINEAR THERMAL EXPANSION 10^5 in/in°F	TENSILE STRENGTH BREAK PSI	WATER ABSORPTION % 24 hrs	DEFLECTION TEMP. °F @ 66 PSI	DEFLECTION TEMP. °F @ 264 PSI	COST c/lbs LOT SIZE
CYCOLAC GRADE L	ABS	BORG-WARNER	.005/.007	3.6	3.2	7.0	3.0	4.0	7,000	.07	180	190	.92
(Acrylonitrile-Butadiene-Styrene)													
479H3 TENITE	CB	EASTMAN	.005/.007	3.0	2.5	1.3	0.6	110 to 170 X10-6 in/in per °C	5,600	1.8	183	208	.97
(Cellulose Butyrate)													
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(Polyarylene Ether)													
PPO		GENERAL ELECTRIC	NO LONGER	MARKETED -	SHELF LIFE	/ CRACKING	PROBLEM						
(Polyphenylene Oxide)													
#35063 HDPE		DOW	.007/.009	1.8	2.05	6.9	* 1.6	* 11.0	4,100	-.01	170		41/43
(High Density Polyethylene)													
ZYTEL 42	NYLON	DU PONT	.015	2.6/4.0	4.1	1.3		4.5	8,500	1.5	220	470	1.34
(Nylon 6/6)													

* ESTIMATED

Attachment 1

DWARF LAUNCHER SYSTEM

WORST CASE COSTS

	SLEx Wt x Matl Cost/lb x 2.5	(SLC Tube Cost + Breakout Cap Obturator, Etc.	100 Firings Cost Per Shot
CAD Firing at Top	(2.65 x 1.34 x 2.5)	($4.08* + $3.63)	SLC 7.71 SLEx .09
	$8.88	$7.71	$7.80
CAD Firing at Bottom	(4.05 x 1.34 x 2.5)		SLC 7.71 SLEx .44
	$13.57		$8.15
	+		
Hardware for Functioning AC Pulses	20.00 $43.57	$7.71	
"A" Size SLC		$10.63	$10.63

SAVINGS

	"A" SLC-(SLC/SLEx)=Savings
CAD Firing at Top	10.63 - 7.80 = $2.83
CAD Firing at Bottom	10.63 - 8.15 = $2.48

*"A" Size ABS Tube = $7
Dwarf .4 length of "A" Size:$2.80 for ABS Dwarf Tube
For Nylon 2.80 x 1.34/.92 = $4.08

DWARF SLC/SLEx ESTIMATE COSTS

Configuration	Weight	Cost (Matl Dependent)
LAU 111/A	4.62#	$10.63
DWARF SLC	2.05#	$7.13 - $8.73
SLEx/Top (Plastic)	2.65#	$6.10 - $8.88
SLEx/Bottom	4.05#	$19.32 - $23.57
SLEx/Top (Alum)	5.4#	$138.75

Material	Re for Selection	Cost/Lb
ABS	Past Performance	0.92
Cellulose Butyrate	30 to 40% non petrochemical	0.97
Polyanylene ether	*Equivalent or tougher than ABS*	1.15
Polyethylene	Econonical; less tough than ABS	0.43
Nylon	Moderately tougher than ABS	1.34

All material cost are constantly rising.

APPENDIX B

DRAWING LISTS - PROTOTYPE SYSTEMS

DRAWING LISTS - PROTOTYPE SYSTEMS

Top Firing SL/DSLS

ES 100	Top Firing Dwarf Sonobuoy Launcher System
101	Extender, TF-SL/DSLS
102	Header, Fixed Breech
103	Tube, Extender
104	Header, DSLC
105	Cushion, DSLC Header
ES 300	Top Firing DSLC
301	Breech Cap
302	Container Tube

Bottom Firing SL/DSLS

ES 200	Bottom Firing Dwarf Sonobuoy Launcher System
201	Extender, BF-SL/DSLS
202	Header, Fixed Breech
203	Tube, Extender
204	Header, DSLC
205	Handle, Extender
206	Contact Terminals
207	Twisted Wire Cable
208	Cap Receptacle
209	Cushion, DSLC Header
210	Dual Locking Nut
211	Rod, Locking
212	Collar, Grip
213	Collar, Locking
214	Collar, Detent
275AS109	Cap Assembly, CAD
ES 400	Bottom Firing DSLC
302	Breech Cap
401	Container Tube

Refurbishing Kit

ES 500	Refurbishing Kit
501	Support, Breech Cushion
502	Cushion Breech
503	Obturator
502-X	Cushion, Muzzle
504	Cord
505	Breakout Cap
506	Lug, Shear
MS29513-154	"O" Ring, Breakout Cap

APPENDIX C

TECHNICAL MEMORANDUM NO. ACSTD-TM-2069
EVALUATION TESTING OF MATERIALS ENGINEERING (60613)
DWARF SONOBUOY EXTENDER (SLEx) SYSTEMS
OF 4 FEBRUARY 1981

DEPARTMENT OF THE NAVY
NAVAL AIR DEVELOPMENT CENTER
WARMINSTER, PA. 18974

Aircraft and Crew Systems Technology Directorate

Technical Memorandum No. ACSTD-TM-2069 4 February 1981

EVALUATION TESTING OF MATERIAL ENGINEERING (60613)
DWARF SONOBUOY EXTENDER (SLEx) SYSTEMS

AIRTASK NO. A3705490/001C/0W0495AS01

Prepared by: F. T. PERRY

Approved by: D. R. AGNEW

Approved by: J. J. DE LUCCIA, Superintendent
Aero Materials Division

INTRODUCTION

(1) The investigation of various types of sonobuoy launch extenders (SLE_x) that would be used in conjunction with the proposed shortened or dwarf type sonobuoys was conducted by the Aircraft and Crew Systems Technology Directorate (ACSTD) of the Naval Air Development Center. The use of these extending devices would permit, without aircraft retrofit, the deployment of the shorter sonobuoys from the majority of the systems now in operation in the Navy.

(2) Also investigated were a variety of plastic materials that were considered to have the required capabilities necessary to sustain a maximum service life.

Description of Test Systems

(1) Two types of sonobuoy launch extenders (SLEx) were designed to accomplish the ejection of the dwarf sonobuoy from the dwarf sonobuoy launch containers (DSLC).

(a) Type I SLEx Top Firing (T/F) Photo No. 1

(1) In this design, the SLEx T/F is adapted to the DSLC using a locking lug on the breech end of the DSLC. When the SLEx T/F is fitted with a cartridge initiator (CAD), the total dwarf launcher assembly (DLA) can be installed in all types of ASW aircraft sonobuoy deployment systems that currently utilize the "A" size SLC.

(2) When the CAD is actuated, the discharge force passes through a center tube of the SLEx that is secured to the DSLC, and the pressure ejects the sonobuoy. In this design the DSLC and the SLEx are assembled as one unit by the crewman and are then installed in the aircrafts launching system.

(b) Type II SLEx Bottom Firing B/F Photo No. 2

(1) In this design the SLEx B/F can be fitted into the aircraft launch tube where it would remain. This would permit the crewman to assemble a series of DSLC's with CAD's which then can be installed in the launching tube by securing the DSLC to the emplaced SLEx; however, it would be necessary to have an empty DSLC remain with the SLEx B/F in order to provide DLA structural and aircraft heat loss integrity for the S3A aircraft.

(2) SLEx B/F deploy the dwarf sonobuoys using a CAD that is threaded into the DSLC. The CAD is discharged by an electric signal from the aircraft breech chute contact through the SLEx.

(3) The SLEx B/F can be also used as a single unit in that the DSLC can be positioned and a locking rod is pivoted which secures the two halves of the SLEx and the DSLC thus forming a standard "A" size configuration. It is to be noted however that SLEx cannot be utilized in the LAMPS Mark III pneumatic launching system as presently configured.

Description of the Plastic Types Investigated

(1) Based on the results of the weight/cost analysis for the dwarf launcher assembly (DLA) which is detailed in NADC technical memorandum 6061 of 13 March 1980, plastic materials of five (5) types were investigated in these SLEx evaluations.

Material Types Tested

Matl.	Mfg. Identification	Manufacturer
a. ABS	Cycolac Grade L	Borg-Warner
b. CB	47943 Tenite	Eastman
c. Noryl	N190-N190	General Electric
d. HDPE	#35063	Dow
e. Nylon	Zytel 42 6/6	Dupont

a. ABS: Acrylonitrile - Butadiene - Styrene
b. CB: Cellulose-Butyrate
d. HDPE: High Density Polyethylene

Description of Tests Conducted

(1) Testing of the T/F and B/F SLEx systems are detailed in the succeeding text and Table 1. The investigational program covered the following:

a. Firing at environmental extremes
b. Shock/impact/vibrational extremes
c. Discharge force analysis
d. Fit and form/test firings from various aircraft
e. Tip over testing duplicating field usage

(2) Testing was conducted at the following facilities:

a. NWSC, Crane, Indiana
b. NADC, Bldg. #80, Warminster, Pennsylvania
c. NOS, Indian Head, Maryland
d. Sikorsky Aircraft Company, Stratford, Connecticut
e. NAS, Lakehurst, New Jersey
f. NADC, Key West, Florida

(3) Description of Tests and Results

a. NWSC, Crane, Indiana conducted vibration/firing evaluations of the ABS pre-prototype type design SLEx T/F and B/F. The firing test of the SLEx T/F was conducted using the NWSC facility (i.e., a modified P3C launching system).

(1) Results - The SLEx T/F and B/F units completed the testing with no noticable failure or physical damage except as noted in Appendix A (A-3, para. 3.b).

(2) Complete test results are reported in NWSC Report - File #3061 MS:PD 13260-31 Mar 1980, Appendix A, (A-2).

b. Ambient temperature test firings were conducted at NADC Bldg. #80 on the ABS pre-prototype SLEx T/F-B/F designs. Total firings 80 each T/F-B/F at +40°F to +60°F.

(1) Results - no failure.

(2) Complete test results reported in NADC memo 6061 of 22 April 1980, Appendix A, (A-10).

c. Low temperature test firings were conducted at NADC, Bldg. #80 on ABS pre-prototype SLEx T/F B/F designs. Total firings 10 each T/F-B/F at -65°F ± 2°F.

(1) Results - no failure.

(2) Total test results are reported in NADC memo 6061-2 May 1980, Appendix A, (A-16).

d. S-3A/dwarf launcher assembly (DLA) fit test were conducted at NADC. A determination of the loading length of the ABS pre-prototype SLEx T/F-B/F units was conducted. The aircraft launcher chutes which were considered to have the least ground clearance when the aircraft is flight ready (i.e., fully loaded with fuel) were designated.

(1) Results - fit test results indicated no installation problems.

(2) Total results are reported in NADC memo 6061 of 22 April 1980, Appendix A, (A-12 to A-15).

e. ABS pre-prototype SLEx T/F interface to the LAMPS Mark III was performed at the Sikorsky Aircraft facility in Stratford, Connecticut. A determination of the form and fit and the test firing of the DLA utilizing the LAMPS Mark III pneumatic launch system was conducted.

(1) Results - firings indicated there was no problem in mounting DLA to the LAMPS Mark III.

(2) Total report of results are detailed in Trip Report F. T. Perry of 6 June 1980, Appendix A, (A-18).

f. Instrumented test firings at ambient temperature +62°F to +67°F was conducted at NADC, Bldg. 80. The exit velocity, barrel pressure and reactive force were determined on the ABS pre prototype T/F-B/F samples, total firings 20: 10 T/F, 10 B/F.

(1) Results - The DLA indicated no failure and the recorded findings were consistant with existing requirements.

(2) Total test results are reported in NADC memo of 10 June 1980, Appendix A, (A-19 to A-21).

g. Test firings at various temperatures were conducted at NOS, Indian Head, Maryland on the ABS SLEx T/F pre-prototype DLA. A total of 133 firings at the following temperatures were observed.

33 cycles at -40°F
33 cycles at -65°F
33 cycles at +160°F
34 cycles at ambient temp. approx. +60°F

(1) Note: No failures reported, however, the test results are incomplete from NOS, Indian Head, Maryland.

NOTE: The following test were performed on SLEx T/F-B/F units manufactured at NADC to the requirements of the prototype drawings using the material herein listed.

h. Ambient temperature firings +72 to 78°F, total 20:10 each T/F and B/F were performed at NADC, Bldg. #80 on the following materialand SLEx types:

ABS T/F-B/F
CB T/F-B/F
NORYL B/F
HDPE B/F
Nylon B/F

(1) Results - CB #A T/F and CB #1 B/F experienced tube failure. Other material types indicated no failure - Photo #3.

(2) Reported in NADC memo 6061 of 8 August 1980, Appendix A, (A-22).

i. Low temperature test firings of prototype samples were conducted at NADC, Building #80. Test requirements specified that DLA were to be conditioned for three hours at -65°F ± 2°F and each were to be fired for 10 cycles or to failure. It is to be noted per Table 1 (i) these tests were initiated at NOS, Indian Head, MD but completed at NADC, Building #80.

(1) Results - CB #2 B/F tube broke, Noryl #1 B/F one lug chipped at the DSLC header joint. Other samples had no failures - Photo #3.

(2) Reported in NADC Memo 6061 - 23 August 1980, Appendix A, (A-23).

j. Taped break out cap firings as per the requirements of NAVAIR-28-SSQ-500 on ABS B/F samples were conducted at ambient temperature +65 to 70°F.

(1) Results - Three test firing with taped break out caps were performed. No failures.

(2) Reported in NADC memo 6061 of 19 September 1980, Appendix A, (A-24).

k. Firings of SLEx T/F-B/F prototype samples with breakout caps taped from a P-3C aircraft at NAS, Lakehurst, New Jersey was performed.

(1) Results - the 12 sample types indicated below were fired from the aircraft.

ABS	T/F-3	B/F-2
CB	B/F-1	---
NORYL	---	B/F-2
HDPE	---	B/F-2
NYLON	---	B/F-2

NOTE: 1 T/F ABS pre-prototype was utilized, the rest were prototypes.

All firings were successful, however, ABS #B-T/F had slight strain areas at 2 points at the lug end of the DSLC header.

(2) Reported in NADC memo 6061 of 19 September 1980. Appendix A, (A-25 and A-26).

l. Test firing 12 samples SLEx T/F-B/F from a S-3 aircraft at NAS, Lakehurst, New Jersey. It was noted that the breakout caps were not taped as in the P-3 firings.

(1) Result - the firings were performed without incident. All samples indicated no change.

(2) Reported in NADC memo 6061 of 26 September 1980, Appendix A, (A-27 and A-28).

m. Shock test as per the requirements of MIL-L-81745A(AS) Amendment 1, paragraph 3.7.5 on the following SLEx T/F B/F DLA was conducted at NADC.

ABS	T/F	B/F
NORYL	---	B/F
HDPE	---	B/F
NYLON	---	B/F

The tests consisted of an average shock load of 13.6 G's for a time duration of 16.8 milliseconds for 150 cycles.

(1) Results - the tests were completed without incident.

(2) Reported in NADC memo 6061 of 30 September 1980, Appendix A, (A-29).

n. Dwarf DIFAR hydromechanical test firings were conducted on SLEx T/F, B/F-12 samples. The aircraft utilized was a P-3C. In this evaluation the sonobuoys were discharged from the aircraft. Ten of the DLA were deployed from the external chutes, the ABS #A-T/F and the Noryl #1-B/F were fired from the pressurized internal launchers.

(1) Results - all test sonobuoys were successfully launched without incident, however, as the DLA were being removed from the aircraft the crewman placed the removed units in a vertical position which is accepted

practice, wind currents tipped over five of the samples and 2 (CB #B T/F and Nylon #1 B/F) test extenders shattered at the breech end of the SLEx. The other tipped over units were examined and found to be intact. Photo #4.

(2) Reported in NADC memo 6061 of 6 October 1980, Appendix A, (A-30 and A-31).

o. Tip-over-tests duplicating conditions experienced in paragraph n were conducted on the remaining SLEx dwarf sonobuoy assemblies. Units with discharged CADS implaced were tipped over a concrete slab for 20 cycles.

(1) Results of Completed tip over drops.

Photo 5 - ABS T/F - 20 cycles - no effect.

Photo 5 - ABS B/F - 20 cycles - handle bond to center rod broke 9 cycles.

Photo 5 - HDPE B/F - 20 cycles no effect.

Photo 6 - Nylon B/F - 1 cycle shattered 4 sections.

Photo 6 - Noryl B/F - 2 samples failed 3 cycles at CAD cap area.

(2) Reported in NADC memo 6061 of 20 November 1980, Appendix A, (A-32).

4. Summary

a. Test firing total and temperature experienced.

SLEx Material	Ambient °F +60 to +80	Low Temperature °F -40	-65	High Temperature °F +160
ABS T/F	139	33	43	33
ABS B/F	96	33	10	
CB T/F	1		10	
CB B/F	1		10	
NORYL B/F	10		10	
HDPE B/F	10		10	
NYLON B/F	10		10	

b. SLEx and SLC Weight Comparisons

	Lbs.	
ABS T/F SLEx	3.7	- Header breech had material relief
ABS B/F SLEx	5.2	- Header breech had material relief
CB T/F SLEx	4.6	
CB B/F SLEx	6.5	
NORYL B/F SLEx	6.0	
HDPE B/F SLEx	5.5	
NYLON B/F SLEx	6.4	
ABS SLC	1.7	

c. Investigational Notes

1. Bottom firing locking rods tended to bind on NORYL-HDPE-NYLON B/F DLA samples after repeated cold soak cycles of 3 hours at -65°F. This condition was not noted in the ABS SLEx units.

2. The bottom firing SLEx experienced a problem of misfire caused by frosting of the center contact pin used to fire the CAD after repeated removals from the low temperature conditioning chamber. The frosting caused a restrictive force on the return spring that prevented the circuit contact.

3. SLE_x B/F samples that were manufactured from CB and HDPE were subjected to excessive material shrinkage. After three hours at -65°F, this shrinkage caused the locking rods extension into the breech lug area. This condition prevented the positioning of the SLEx DLA into the correct firing positions.

5. Conclusions

1. SLEx that were manufactured from ABS material presented the least problems in the test program and is considered satisfactory for launching dwarf sonobuoys.

TABLE

1 - Test Conditions, and Site of Test

PHOTOGRAPHS

1 - Type 1 SLEx Top Firing T/F

2 - Type 2 SLEx Bottom Firing B/F

3a. - CB Tube Failure - T/F Field Tests
3b. - CB Tube Failure - B/F Field Tests

4 - Nylon Tube Failure - Field and Tip-Over Tests

5 - ABS/HDPE After Tip-Over Test

6 - NORYL - After Tip-Over Test

APPENDIX A

NADC 60613 MEMOS/TRIP REPORTS - DWARF LAUNCHER ASSEMBLIES

Trip Report - 25 Mar 1980 - Vibration Firings NWSC Crane, IN

Memo - 22 Apr 1980 - Test Firing Dwarf SLEx Ambient Temperature

Memo - 22 Apr 1980 - SLEx Fit Test S3A Aircraft

Memo - 2 May 1980 - Test Firing Dwarf SLEx -65°F

Trip Report - 28 May 1980 - SLEx Fit Test LAMPS MARK III

Memo - 6 Jun 1980 - SLEx Instrumented Firings Ambient Temperature

Memo - 8 Aug 1980 - NADC Prototype SLEx Firings Ambient Temperature

Memo - 23 Aug 1980 - Low Temperature NADC Prototype SLEx Firing

Memo - 19 Sep 1980 - SLEx Firing Taped Breakout Cap Ambient Temperature

Memo - 19 Sep 1980 - SLEx Firing P3C Aircraft

Memo - 26 Sep 1980 - SLEx Firing S3A Aircraft

Memo - 30 Sep 1980 - SLEx Shock Test

Memo - 6 Oct 1980 - Dwarf DIFAR P3C Test

Memo - 20 Nov 1980 - Tip Over Test of SLEx

ABBREVIATIONS/MATERIAL CONTENT

ABS - Acrylonitrile - Butadiene - Styrene
CB - Cellulose Butyrate
NORYL - Polyarylene ether
HDPE - High Density Polyethylene
NYLON - As indicated

SLEx - Sonobuoy Launch Extender
DLA - Dwarf Launcher Assembly
T/F - Top Firing SLEx
B/F - Bottom Firing SLEx
CAD - Cartridge Actuated Initiator

See Text Para.	TEST CONDITIONS AND SITE OF TEST	Date	ABS T/F	ABS B/F	CB T/F	CB T/F	Noryl T/F	Noryl B/F	HDPE T/F	HDPE B/F	Nylon T/F	Nylon B/F
3a(1)	3 axes, 9 hr. vibration test per SPD-7A - NWSC, Crane Indiana Related report - NSWC File #3061 MS:PD 13260 - 31 Mar 80	3-17-80	No fail.	No fail.								
3a(2)	Test Firing (1 cycle) NWSC Crane Indiana Launch System Related Report - (as above)	3-17-80	No fail.									
b.	Amb. temp. +40/60°F test firings Bldg. 80 80 T/F 80 B/F 160 total Reported in 60613 memo to 6061 - 22 Apr 1980	3-28-80	No fail.	No fail.								
c.	Low Temp. -65°F±2°F, test firing Bldg. 80 - 10 T/F 10 B/F 20 total - 3 hr. soak - Reported in 60613 memo to 6061 - 2 May 1980	4-28-80	No fail.	No fail.								
d.	S-3A Dwarf launcher fit test, min. clear chute - fully fuel loaded - NAS Warm. - Reported in 60613 memo to 6061 - 22 Apr 1980	4-22-80	Fit OK	Fit OK								
e.	LAMPS Mark III fit/firing test - pneumatic ejection - Sikorsky Aircraft Co., Stratford, CN - Reported in Trip Report, E. T. Perry, 60613, 6 Jun 1980	6-6-80	No Fail.									
f.	Amb. Temp. 62/6/°F Instrumented (Exit velocity - Barrel Press - Reactive Force) 10 T/F. 10 B/F Bldg. 80 - Reported in 60613 memo to 6061 - 10 Jun 1980	6-10-80	Results OK									
g.	Testing conducted at NOS, Indian Head, MD SLE$_x$ T/F											
	(a) 33 cycles @ -40°F		No fail.									
	(b) 33 cycles @ -65°F		No fail.	See NOTE								
	(c) 33 cycles @ 160°F		No fail.									
	(d) 33 cycles @ ambient 70°F		No fail.									
	NOTE 1 - No failure after NADC refit of firing system											

ABS SLE, ORIGINAL DESIGN - NOT TO FINAL PROTOTYPE DWGS.

TABLE I
1 of 3

See Text - Para	TEST CONDITIONS AND SITE OF TEST	Date	ABS T/F	ABS B/F	CB T/F	CB B/F	NORYL T/F	NORYL B/F	HDPE T/F	HDPE B/F	Nylon T/F	Nylon B/F	ABS B/F with C - Lug Lock SLC
	TEST FIRING CYCLES/RESULTS												
	Testing conducted at NAS, Indian Head, MD												
	Results - Incomplete												
	1st TESTS OF SLE DESIGN TO NADC DWGS OR 5 MATL. TYPES												
h.	Ambient tests 72/78°F - 10 cycles each Bldg. 80	8/8/80	No Fail.	No Fail.	A Tube Fail.	#1 Tube Fail.	No Sample constructed	No Fail.	No Sample constructed	No Fail.	No Sample constructed	No Fail.	
i.	Low Temp - 65°F Tests - 10 cycles each - start NAS, Indian Head, finished Bldg. 80 - reported in 60613 memo to 6061 - 23 Aug 1980	8/23/80	No Fail.	No Fail.	B No Fail.	#2 Tube Fail.		One lug muzzle end.		No Fail.		No Fail.	
j.	Ambient temp. test 70/76°F - 3 cycles - lug lock SLC/taped breakout cap, Bldg. 80, reported in 60613 memo to 6061 - 19 Sep 1980	9/18/80		No Fail.									
k.	Aircraft test firing P-3C - taped break-out caps - NAS Lakehurst NJ reported in 60613 memo to 6061 - 19 Sep 1980	9/19/80	No Fail. 2 pts. strain ext. muzzle end	No Fail.	B No Fail.	Out		No Fail.		No Fail.		No Fail.	No Fail.
l.	Aircraft test firing S-3 various airspeed/altitudes - NAS Lakehurst NJ reported in 60613 memo to 6061 - 26 Sep 1980	9/26/80	No Fail.	No Fail.	B No Fail.	Out		No Fail.		No Fail.		No Fail.	No Fail.
m.	Shock test - 13.6G/18.8 mill sec - 150 cycles MIL-E-81/45A(AS) NADC, Warminster, reported in 60613 memo to 6061 - 30 Sep 1980	9/30/80	No Fail.	No Fail.				No Fail.		No Fail.		No Fail.	
n.	Dwarf DIFAR hydromechanical test - P 3 aircraft NADC Key West Florida reported in 60613 memo 60 6061 - 6 Oct 1980	10/6/80	No Fail.	No Fail.	B No Fail.			No Fail.		No Fail.		No Fail.	No Fail.
						Off loading mishandling snaps center tube							

2 of 3

		TEST FIRING CYCLES/RESULTS													
TEST CONDITIONS AND SITE OF TEST	Date	ABS T/F	ABS B/F	CB T/F	CB B/F	Noryl T/F	Noryl B/F	HDPE T/F	HDPE B/F	Nylon T/F	Nylon B/F	ABS B/F with C Lug Lock SLC			
6. Tipover test=concrete floor = 20 cycles = NADC reported in 60613 memo 6061 - 20 Nov 1980	11/20/80	No Fall.	Handle Bondng Otherwise OK	Out	Out	-	Fall 2 samples CAD cap area	-	No Fall.	-	Fall shatters 4 sections				

See test para M

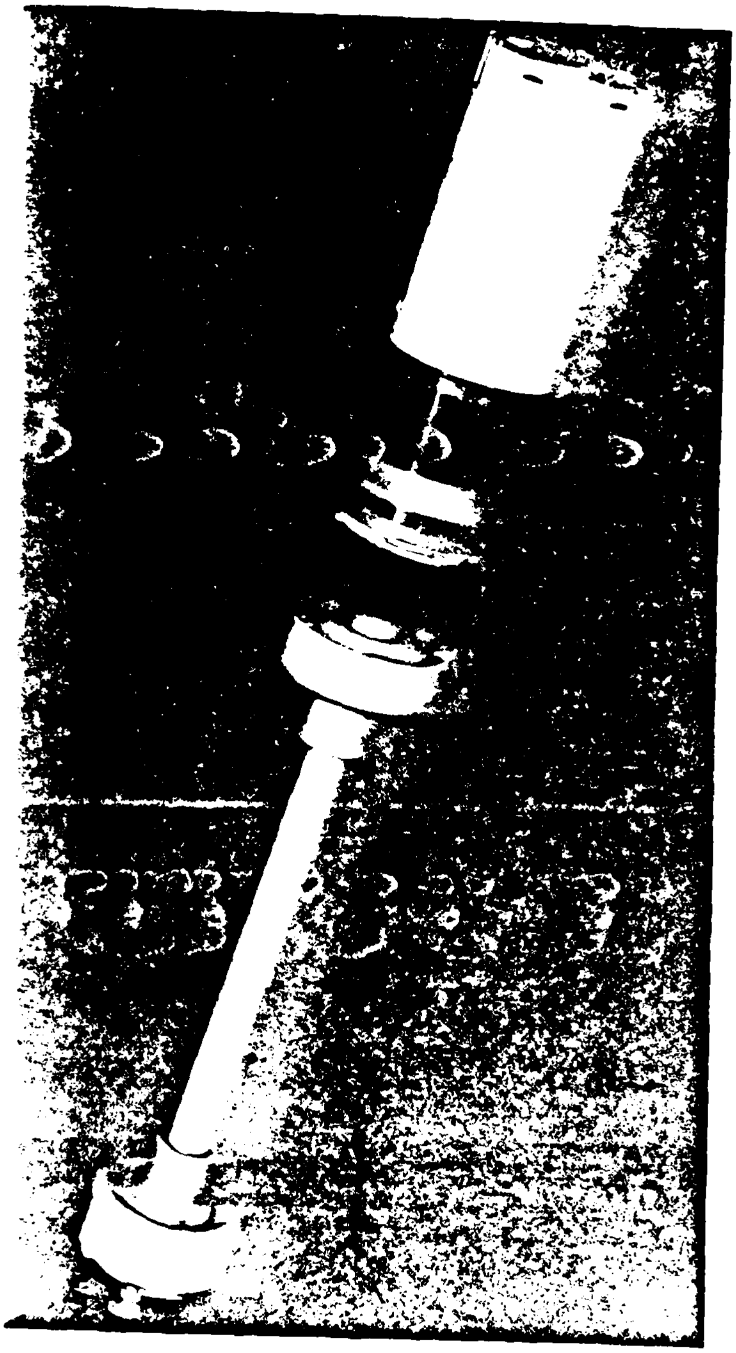
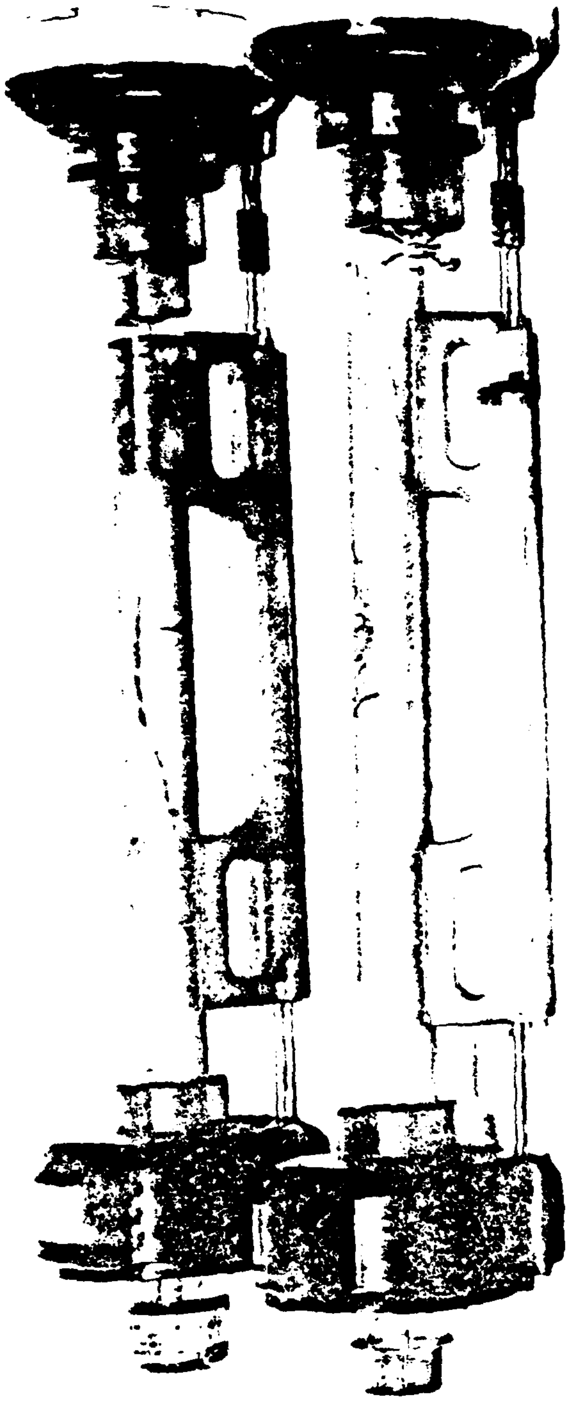


PHOTO 1 - Type I SIE_x Top Firing 1/4

PHOTO 2 - Type 2 SIE$_x$ Bottom Firing B/I

CB

PHOTO 3a - CB Tube Failure
T/F Field Tests



CB

PHOTO 36 - CB Tube Failure
B/F Field Tests

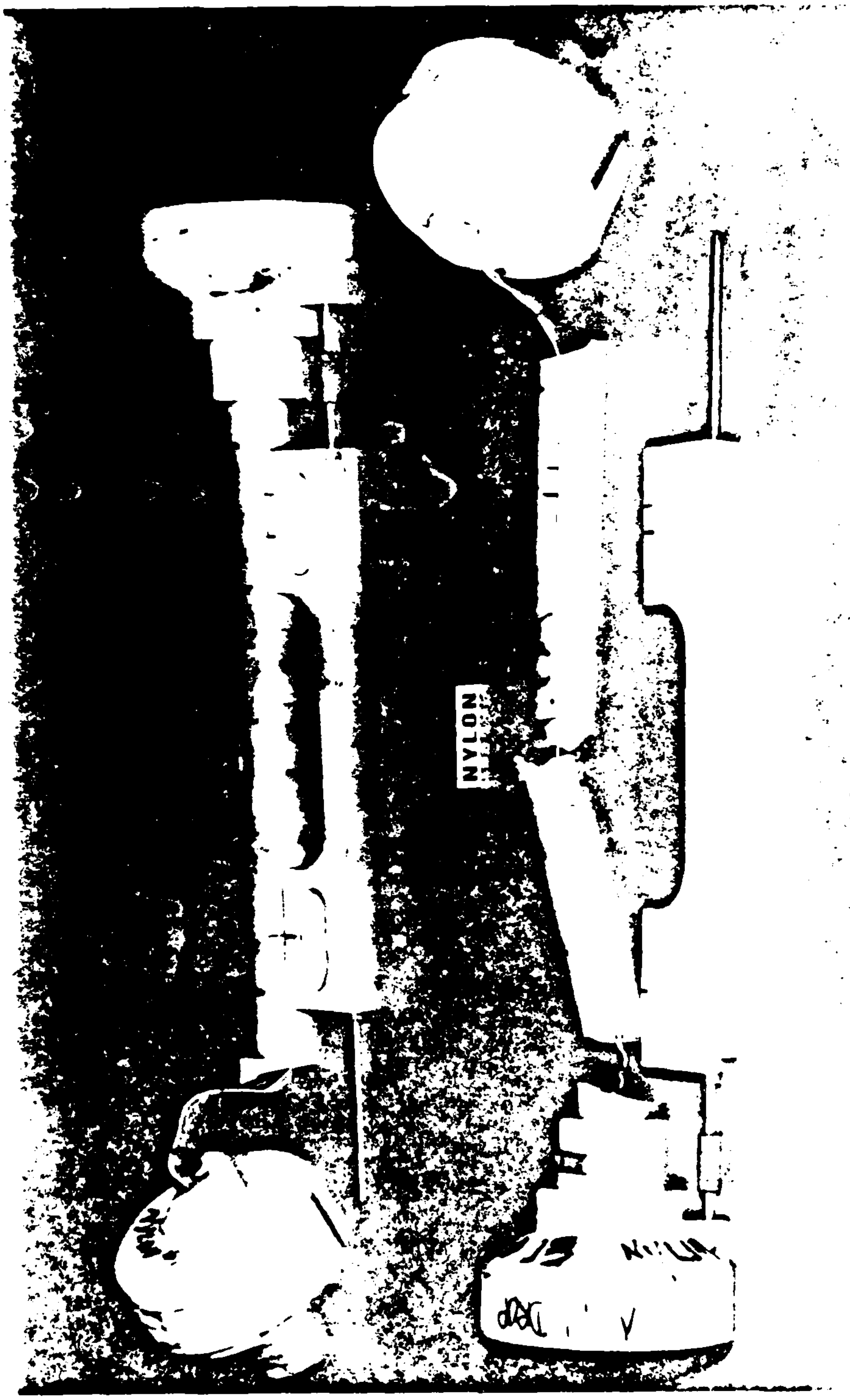


PHOTO 4 Nylon Tube Failure
Field and Tip-Over Tests

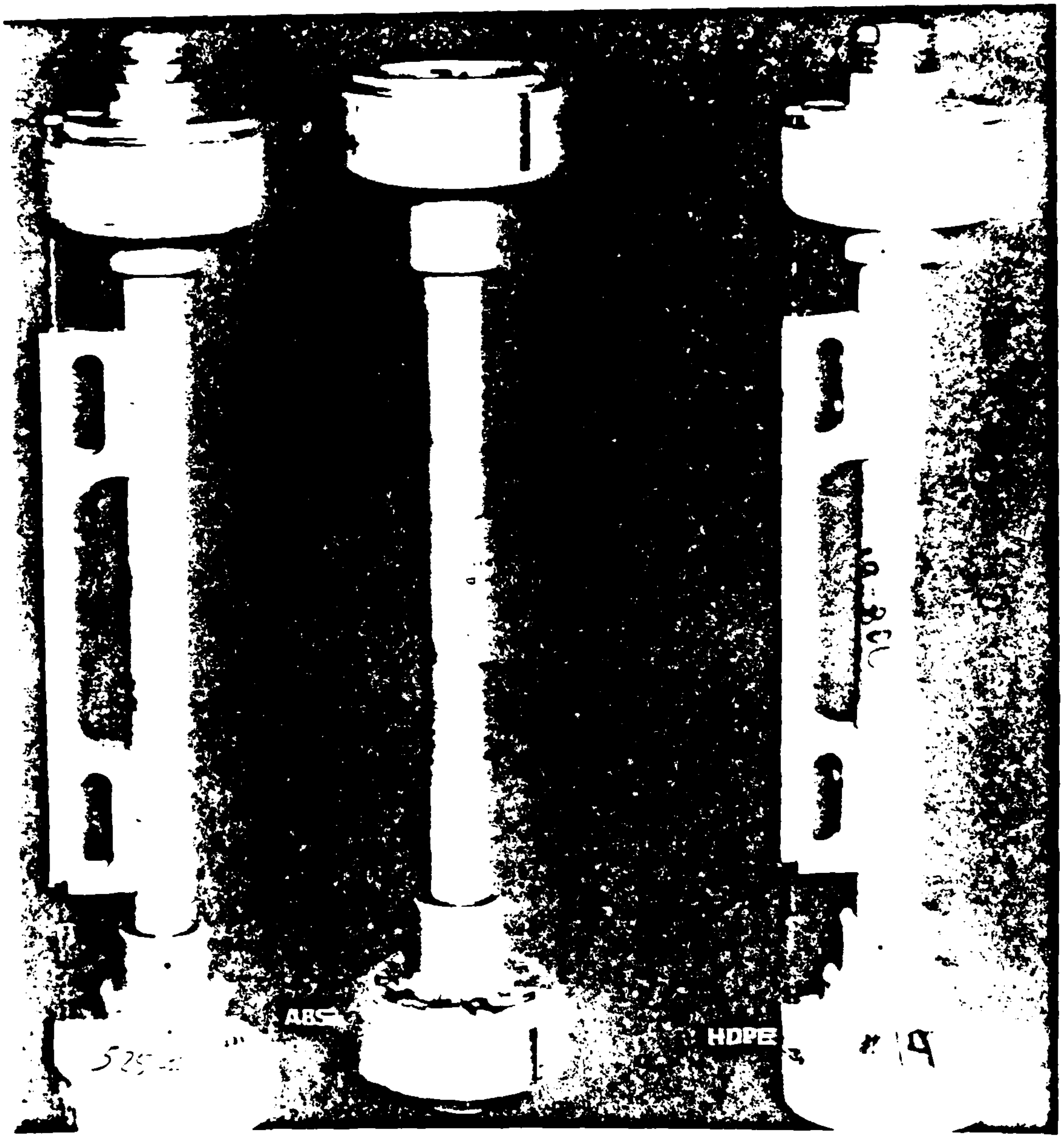
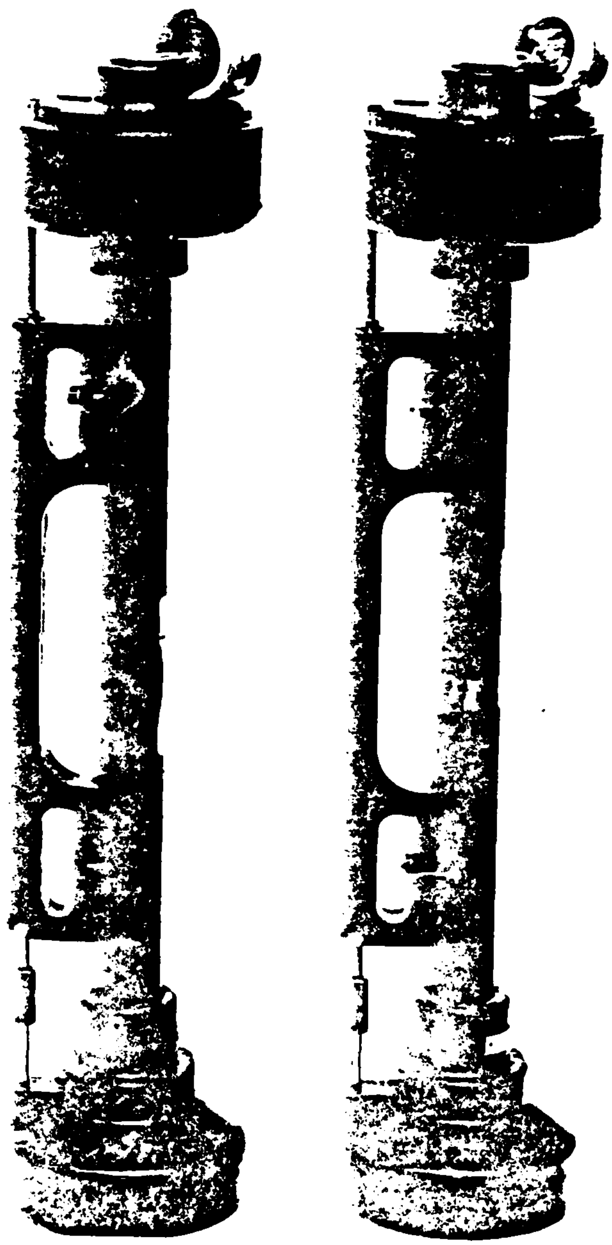


PHOTO 5 - ABS/HDPE After Tip-Over Test



NORYL

PHOTO 6 - NORYL - After Tip-Over Test

CONFERENCE/TRIP/TELCON REPORT
NADC-3930/1 (10-66)

SUBJECT/PROJECT	DWARF SONOBUOY PROGRAM	
PURPOSE: VIBRATIONAL TESTING	PLACE: NWSC CRANE IND.	DATE: 3-17-80 3-28-80
DISCUSSION WITH: MR. M. SCHERSCHEL CODE. 3061		TELEPHONE NO.(S): 810482-1422

☐ SEE ADDITIONAL SHEETS

DISCUSSION BRIEF

1. FACILITY USE FOR THE VIBRATIONAL TESTING OF THE DEVELOPMENTAL DESIGN OF TOP FIRING AND BOTTOM FIRING ADAPTERS TO BE USED WITH DWARF SONOBUOYS.
2. TEST FIRING OF ABOVE TOP FIRING ADAPTER

CONCLUSION/AGREEMENT

TESTED TO REQUIREMENTS OF ETP 1923 WITHOUT FAILURE

COMMITMENTS

NADC	OTHER
NONE	

SIGNATURE	CODE	DATE OF REPORT
[signature]	6063	3-25-80

COPY TO:

PLATE NO. 13679

APPENDIX A

No. 3061MS:PD13260-31 Mar 80

Naval Weapons Support Center

Vibration Test

of

Dwarf Sonobuoy Launcher Containers

Prepared by
Weapons Quality Engineering Center
Crane, Indiana

Ref: (a) Work Request N62269/80/WRC0541

1. Introduction - NAVAIRDEVCEN, Warminster, by reference (a), tasked NAVWPNSUPPCEN Crane to conduct vibration tests of two dwarf sonobuoy launcher containers (SLC's). The tests were conducted during the week of 17 March 1980 with Mr. Frank Perry of NADC, Warminster, witnessing the tests. A test fixture utilizing a P-3C launch tube was used for conducting the test.

2. Description of Test Items - Both dwarf SLC designs were molded from ABS plastic. One unit (Figures 1 and 2) was denoted as "top firing". The CAD on this design was inserted at the top and made direct electrical contact with the aircraft launcher firing pin. During launch the propellant gas from the CAD travels down the hollow plastic tube to apply pressure to the obturator and dwarf sonobuoy. The other design (Figures 3 and 4) was denoted as "bottom firing". The CAD on this design is inserted directly above the dwarf sonobuoy. The top portion of the design latches to the aircraft launch tube and makes electrical contact with the firing pin. An electrical signal lead is routed down the inside of the plastic tube to the CAD.

3. Summary of Tests

a. Both SLC designs were subjected to the 3 axes, 9 hour vibration test of SPD-7A of 25 October 1978, "Purchase Description for LAU-111/A "A" Size Store Launcher and Package Assembly". Photographs of the test setup are shown in Figures 5 and 6.

b. Both units completed the test with no noticeable physical damage. However, a resistance check of the bottom firing design indicated a short between the ground and positive contacts of the CAD firing circuit.

c. The top firing design was loaded into the Crane CAD launch test facility and fired once. Exit velocity of the dwarf sonobuoy was measured at approximately 48 feet per second which was considered good. The bottom firing design was not subjected to a launch test because of the shorting problem mentioned previously.

d. The test units and copies of the test data were released to Mr. Perry for return to NADC, Warminster.

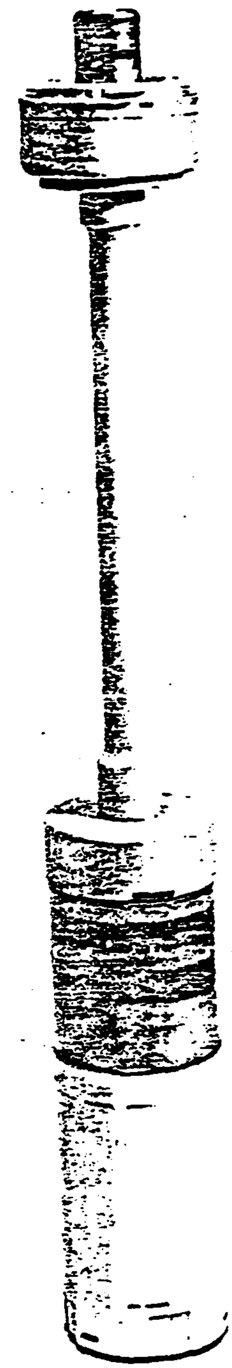


Figure 1: Top Firing Dwarf SLC Configuration. Note CAD is inserted at top for direct contact with launcher firing pin.

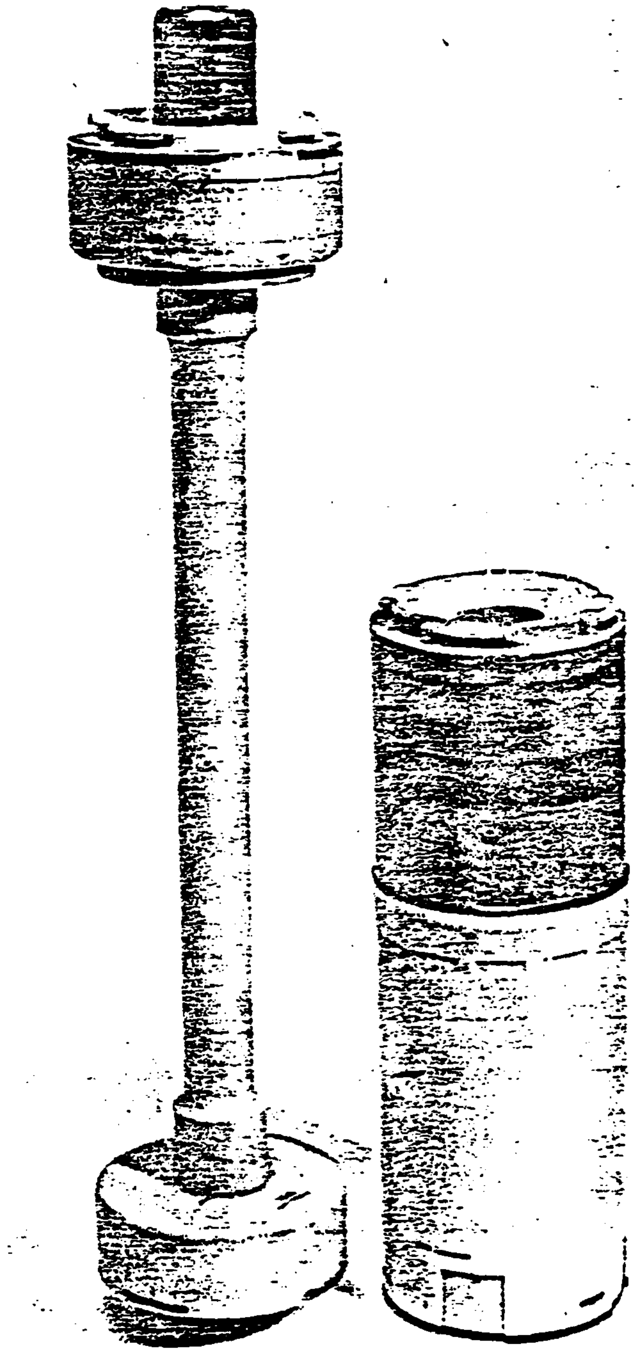


Figure 2:
Top Firing Dwarf SLC Configuration
with Dwarf SLC separated from Launcher
Interface Section.

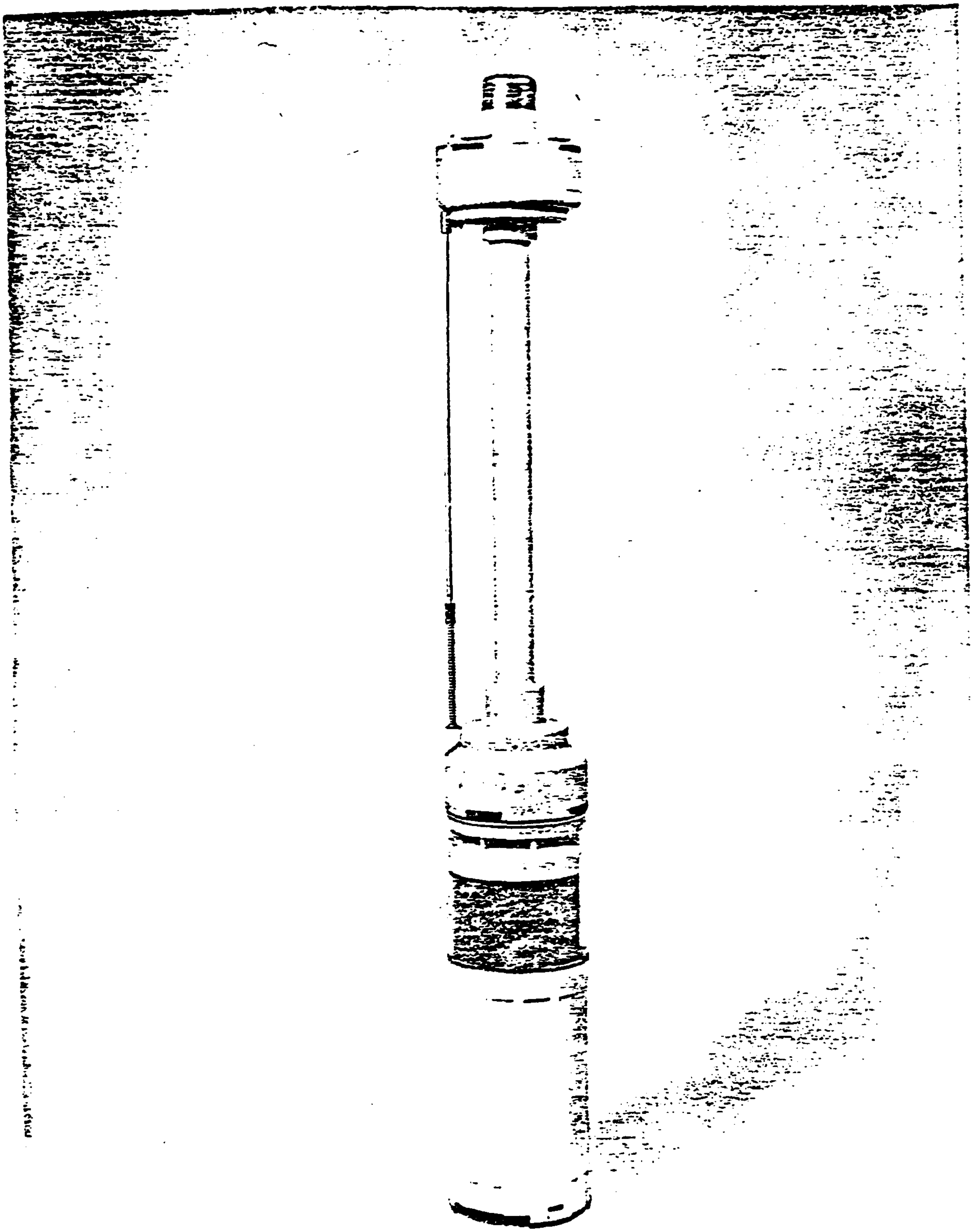


Figure 3: Bottom Firing Dwarf SLC Configuration. Note CAD shaped electrical contact at top. Vertical metal rod prevents rotation of upper section when latched in launch tube.

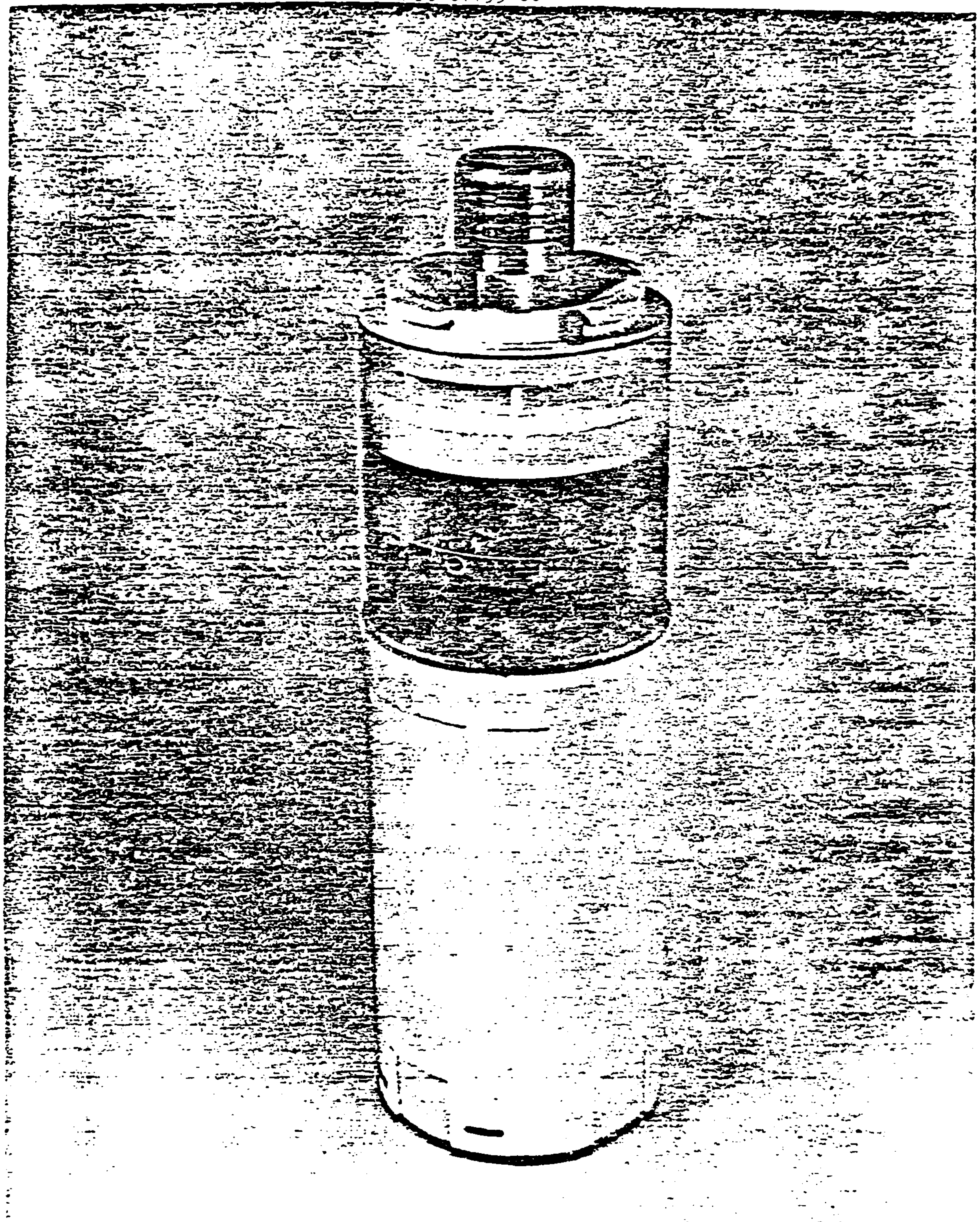


Figure 4: Bottom Firing Dwarf SLC separated from Launcher Interface Section. Note CAD is inserted directly into SLC.

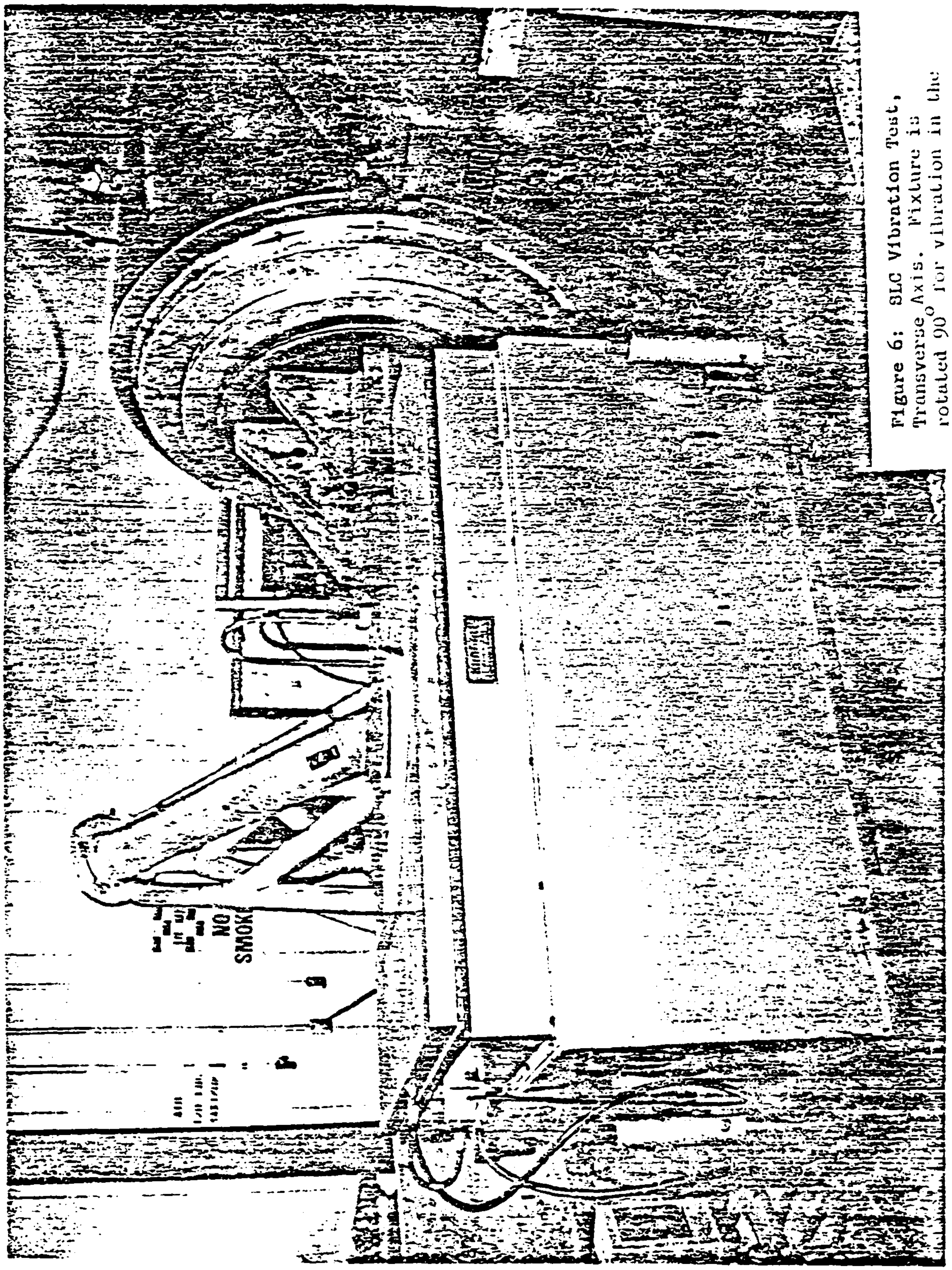


Figure 6: SLC Vibration Test, Transverse Axis. Fixture is rotated 90° for vibration in the third axis.

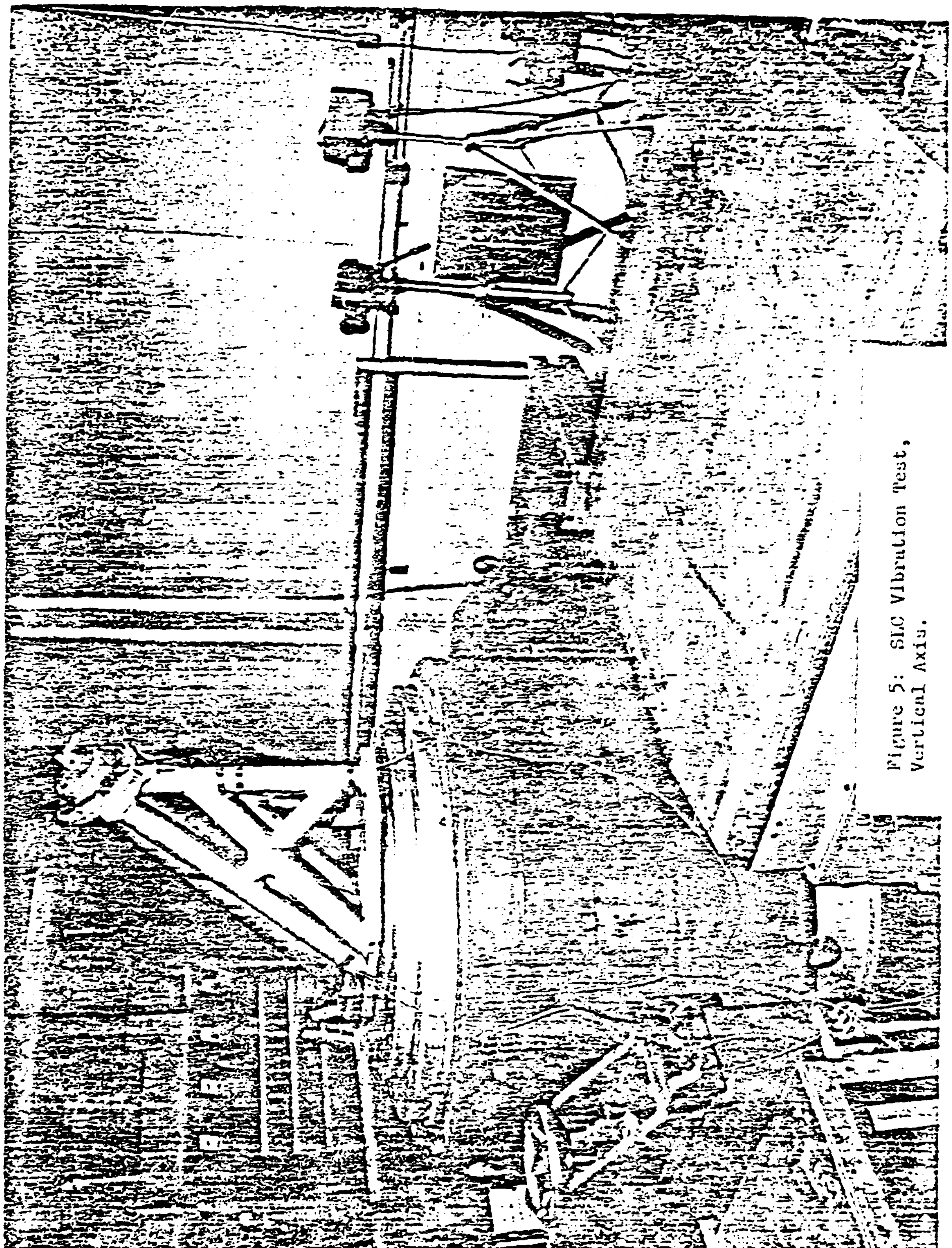


Figure 5: SLC Vibration Test, Vertical Axis.

NAVAL AIR DEVELOPMENT CENTER
AIRCRAFT AND CREW SYSTEMS TECHNOLOGY DIRECTORATE
WARMINSTER, PA. 18974

6061
22 APR 1980

MEMORANDUM
From: F. T. Perry
To: Dwarf Sonobuoy Launcher File

Subj: Test Firing of Dwarf Sonobuoy Launcher Extender Systems

DESIGNATIONS:
TF: CAD fired from top (attached to extender)
BF: CAD fired from bottom (attached to dwarf SLC)
SLC: Sonobuoy launcher container
SLE_x: Sonobuoy launcher extender

1. Test Conditions

a. 160 test firings of types TF and BF, 80 each, were conducted to determine the effect of the reactive and explosive force of the CAD on each SLE_x, also the effect of the same force on the redesigned (lug locks) breech end of the SLC.

b. The SLE_x's, TF and BF, were assembled to dwarf SLC's utilizing dummy loads and fired from a P-3 type launcher system that had been permanently secured in a horizontal mode.

c. All tests were conducted with an ambient temperature that varied from +40°F to +60°F.

2. Test Results

a. Type TF and BF SLE_x were each fired a total of 80 cycles without failure to any part of either SLC/SLE_x assemblies. There was no failure in the breech area of the SLC's used. The condition of the breech lugs of the SLE_x's was continually inspected throughout the test and it was concluded that the test firings had not affected the breech lugs.

b. It was determined that because of the availability of the components that most of the SLC's used throughout the testing were an adaption of the 104 A/A breech and muzzle ring. These had been refitted to accept the dwarf sonobuoy length, however, three (3) of the firings were conducted using the 104 A/A breech end joined to a LAU 111 muzzle ring assembly. Future testing will utilize this concept.

c. It is to be noted that the reuseability of the 104/104 adapted SLC's were as follows:

NOTE: L designation = lug lock
S designation = lug stop only

Identification	104/104
FS	19 firings - muzzle ring failure
GL	51 firings - muzzle ring failure
CS	59 firings - no failure
EL	28 firings - no failure
	104/111
AS	2 firings - no failure
BS	1 firing - no failure

d. The failure rate (missfires) of the CAD's used in this test appears to be 10 to 12% with noticeable discharge force variation of individual CAD's. Identification of CAD's as follows:

Initiator Cartridge Activated JAU 1/B
275A5100G-05-ER1-06 79

3. Conclusions

a. Based on the test results, the SLE_x's TF and BF, using ABS plastic appear to function without failure under the conditions herein stated.

b. Dwarf SLC's manufactured using 104/104 breech and muzzle assemblies withstand numerous firings without failure. The failure of SLC samples FS-GL occurred at the muzzle ring, failure did not occur at the breech end redesign made necessary by the inclusion of the lug lock feature.

c. CAD failure rate was considered significant also the variation in the discharge force was noted. In at least 4 instances flame was visible when the dummy sonobuoy was ejected, however, this condition was confined to the top fired SLE_x design and only to the SLC interior, the flame extent was approximately 1/2 of the interior length of the SLC.

F. T. PERRY

Franklin Perry

NAVAL AIR DEVELOPMENT CENTER
AIRCRAFT AND CREW SYSTEMS TECHNOLOGY DIRECTORATE
WARMINSTER, PA 18974

6061
22 APR 1980

MEMORANDUM
From: A. D. Boyd
To: Dwarf Sonobuoy Launcher File

Subj: S3A/Dwarf Launcher Assembly Fit Test

1. On 11 April 1980, an S-3a (159736) touched down at NADC airfield to refuel, loading up to 12,000 lbs. of fuel.

2. Engineer J. Babiarz secured availability for inspection and external fit and function on the aircraft.

3. Materials engineering test fit two configurations of the prototype dwarf SLC/SLE_x into row "M" and row "P" chutes without problems. The ground clearance ranged from 7/8" to 1½". The 7/8" clearance being for sonobuoy launcher extender (SLE_x) CAD firing at bottom where the locking rod effectively increases the SLE_x O.D. in one quadrant. The 1½" clearance being for the CAD firing at the top and in the three quadrants of the bottom firing not affected by the locking rod.

4. A sample of the Magnavox 111/A, the Sparton 111-A/A and the Hermes 111-B/A was installed in the Row "M" and Row "P" chutes and latched and locked without incident. Minimum ground clearance provided by the "A" size store was 5/8".

A. D. Boyd
A. D. BOYD

File

CONFERENCE/TRIP/TELCON REPORT
ND-NADC-3930/1 (10-66)

SUBJECT/PROJECT
SLEx / DWARF

PURPOSE DISCUSS SLEx / S3A GROUND CLEARANCES.

PLACE

DATE 21 May 80

DISCUSSION WITH LT. RUSS BAKER VX-1

TELEPHONE NO.(S) A/V 356-3681

☐ SEE ADDITIONAL SHEETS

DISCUSSION BRIEF

RE 11 APRIL FIT TEST, VX-1 S3A 159736 WAS USED FOR TESTING AFTER BEING REFUELED. THE BASIC A/C WEIGHT IS 28,272 LBS - INCL. 2 CREWMEN, OIL AND 60 SLC'S. A FULL FUEL LOAD IS 13,100 LBS.

THEREFORE, THE A/C TESTED WEIGHED:

41,372 LBS
- 372 LBS (APPROX WT. OF CREW, WHO WERE NOT IN COCKPIT)
41,000 LBS

CONCLUSION/AGREEMENT

THE ABOVE IS CONSISTENT WITH NATOPS DATA THAT ALSO INDICATES THE A/C WEIGHT WITH FOUR CREW (800#), PYLONS & PYLON FUEL TANKS (1,019#) AND FUEL IN PYLON TANKS (3,604) IS 46,415 LBS. (WITHOUT STORES)

COMMITMENTS

NADC

OTHER

LT. BAKERS MAINTENANCE PEOPLE TOLD HIM THE SUPPOSED GROUND CLEARANCE PROBLEM IS A MYTH. IT DOES NOT HAPPEN.

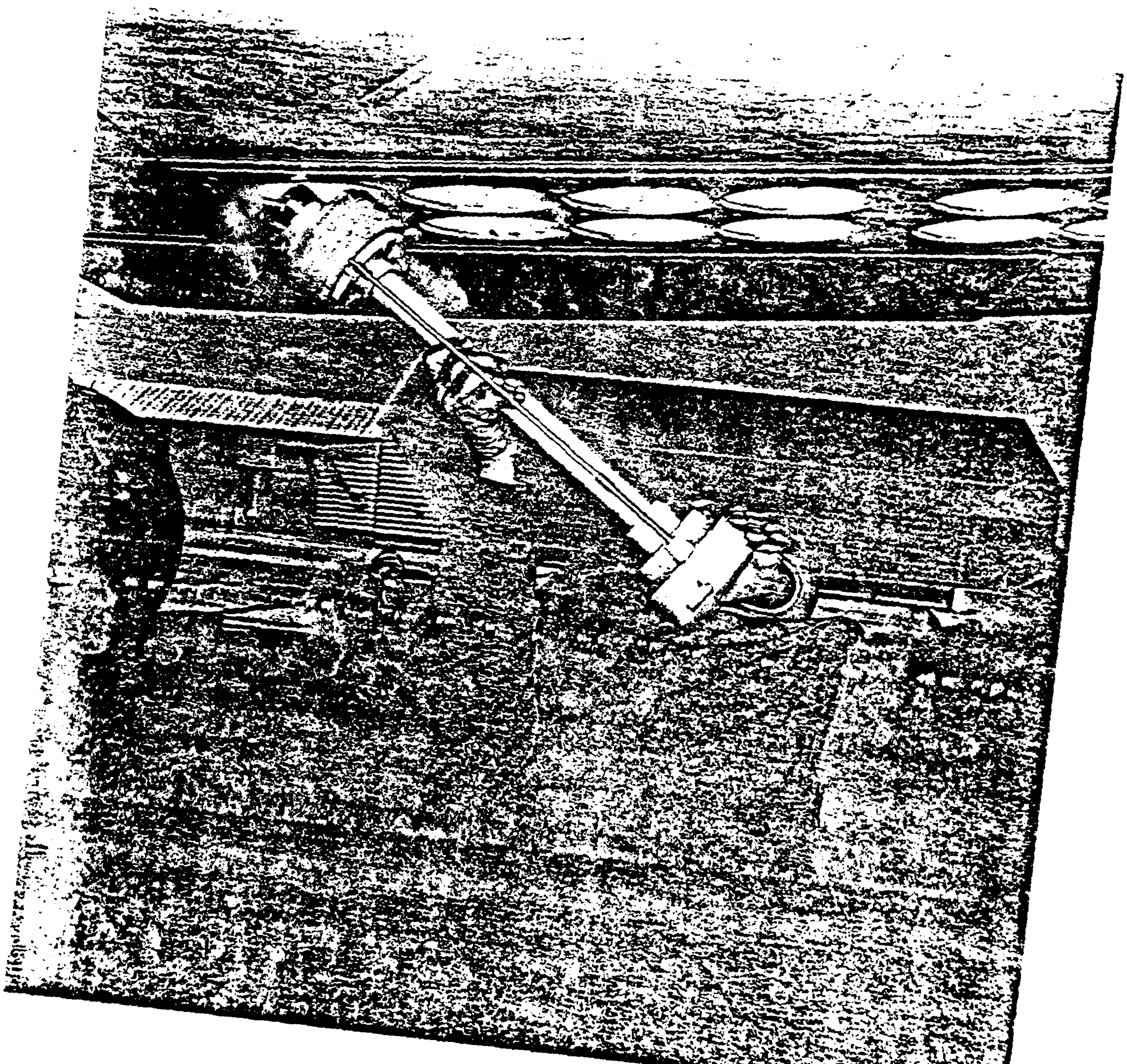
SIGNATURE [signature]

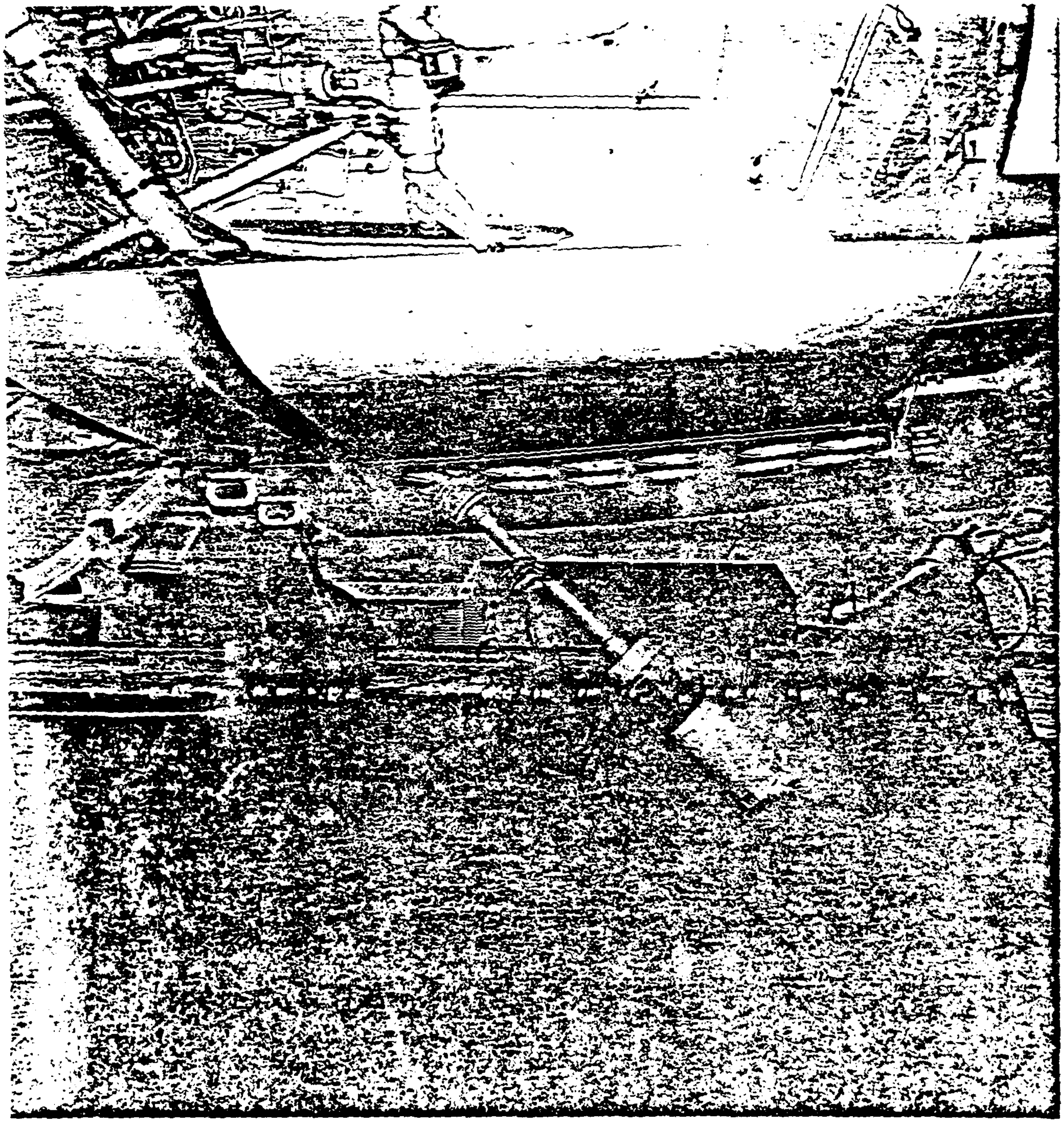
CODE 6013

DATE OF REPORT 21 MAY 80

COPY TO:
Leo D.
Tom Polanowsky

PLATE NO. 18679





NAVAL AIR DEVELOPMENT CENTER
AIRCRAFT AND CREW SYSTEMS TECHNOLOGY DIRECTORATE
WARMINSTER, PA 18974

6061
2 MAY 1980

MEMORANDUM
From: F. T. Perry
To: Dwarf Sonobuoy Luancher File

Subj: Low Temperature -65°F Test Firing of Dwarf Sonobuoy Launcher Extender System

Ref: (a) NADC memo 6061 of 22 Apr 1980

Designations:
TF: CAD fired from top (attached to extender)
BF: CAD fired from bottom (attached to dwarf SLC)
SLC: Sonobuoy Launcher Container
SLE_x: Sonobuoy Launcher Extender

1. Test Conditions:

a. SLE_x, TF and BF extender assemblies that had been fired at ambient temperature for 80 cycles each were conditioned at -65°F ±2°F for a minimum of 3 hours and were test fired 10 cycles each.

b. *Except for the low temperature conditioning,* the test objectives as stated in reference (a) were identical.

c. The SLC's exclusively used in this testing were the 104/111 breech-muzzle combination with the lug stop only.

2. Test Results:

a. Type TF and BF SLE_x were fired for a total of 10 cycles each without failure. All tests were performed on the SLC/SLE_x combinations immediately after removal from the -65°F conditioning chamber, however, it is to be noted that due to a chamber malfunction cycle #4 was fired at -25°F, subsequent repairs eliminated the problem.

b. SLC's were refired during the 20 cycle test indicating an ability to be reused after inspection. The following is the firing record of the SLC's used:

No. 1	3 cycles - no failure
No. 2	5 cycles - no failure
No. 3	2 cycles - no failure
No. 4	3 cycles - no failure
No. 5	4 cycles - no failure
No. 6	2 cycles - no failure
No. 7	1 cycle - no failure

3. Conclusions:

a. Based on the low temperature (-65°F) test results, it is concluded that the ABS plastic used in the construction of the SLE_x was uneffected by the firings.

6061
2 MAY 1980

b. The repeated firing of SLC's using the 104/111 configuration indicated that the lug and breech joint was unaffected by the CAD force.

F. T. PERRY

Franklin T. Perry

CONFERENCE/TRIP/TELCON REPORT

SUBJECT/PROJECT: SLE$_X$ /BUARE		
PURPOSE: SLE INTERFACE TO LAMPS MARK III - FIRING	PLACE: SIKORSKY AIRCRAFT STRATFORD CONN.	DATE: 28 MAY 1980
DISCUSSION WITH: L. MARCIANO. E. KENIGSBERG. — ENG DEPT. 4045 SEA HAWK PROGRAM		TELEPHONE NO.(S)

SEE ADDITIONAL SHEETS

DISCUSSION BRIEF

INTERFACE FIT TEST AND PNEUMATIC FIRING TOP FIRING 60-ABS EXTENDER (61) USING (1) SLC 104/111, (2) SLC 104/104. MFG. CONSTRUCTED INSTALLATION TOOL DID NOT RELEASE THE DETENT LATCH BECAUSE OF SHORT LENGTH OF LATCH TANGS, HOWEVER THE 60 (61) ABS SYSTEM DOES NOT REQUIRE TOOLS. STILL AND MOTION PICTURE COVERAGE OF LAUNCHES WAS ACCOMPLISHED.

CONCLUSION/AGREEMENT

BOTH SLC'S (1) AND (2) WERE FITTED IN THE LAMPS MARK III CONFIGURATION AND FIRED SUCCESSFULLY. THE DUMMY LOAD APPROX 20 - 25 FEET FROM LAUNCHER.

COMMITMENTS

NADC	OTHER
NONE	NONE

SIGNATURE	CODE	DATE OF REPORT
[signature]	60613	6-6-80

COPY TO:

PLATE NO. 18573

U.S. GOVERNMENT PRINTING OFFICE: 1978-703-173 3L59 2 1

OPNAV 5216/144 (REV 6-70)
S/N 0107-LF-776-6029
DEPARTMENT OF THE NAVY

NADC-81193-60

Memorandum

DATE: 6-10-80

FROM: 60613

TO: 6061

SUBJ: Ambient temp instrumented SLE_x top + bottom firings Bldg 80 - 6-6-80. +62/67°F

		TOP	BOTTOM
1. Exit Velocity	AVG. FT/SEC.	59	56
2. Barrel pressure	AVG. PSI	50	49
3. Reactive force.	AVG. PSI/MILSEC.	1930/5.8	2110/3.4

10 firings each SLE_x (top, bottom) No failure

Total firing to date these samples.

Top = 10

Bottom = 100

F.T. Perry
X2062

U.S. GOVERNMENT PRINTING OFFICE: 1978—603-013/3220 2-1

Top Firing (Threaded Insert) Alex Pattlew 6/5/86 1430

PLANNING WORK SHEET
NND-GEN-5200/1 (REV. 9-66)
S/N 0195-LF-202-1101

CAD Firing
Dwarf Buoy.

No	Obturator Pressure (psi)	Reactive Force (lbs.)	Velocity - Reflective (f/s) Middle 3 inches	Velocity - Reflective (f/s) Last 3 inches	Velocity - Broken Beam (f/s) Const. Value	Remarks
1	50	2100	–	–	56	Opt. Out
2	50	2100	–	–	60	Opt. Stuck w/ buoy
3	52	2400 3.8 ms	34	–	55	Opt. stuck w/ buoy
4	50	2200 3.6 ms	48	50	57	Opt. Stuck w/ buoy
5	45	2100 3.5 ms	42	56	54	Opt. Stuck w/ buoy
6	50	2100 3.3 ms	39	50	57	Opt. Stuck w/ buoy
7	40	1900 3.8 ms	42	50	47	Opt. Stuck w/ buoy
8	60	2200 3.3 ms	56	63	67	Opt. Stuck w/ buoy
9	46	2150 3.5 ms	50	52	–	No Broken Beam Data.
10	42	1850 3.0 ms	42	50	52	Opt. Stuck w/ buoy
	48.5	2110 3.4			56	

U.S. GOVERNMENT PRINTING OFFICE: 1976—603-913/5223 2-1

PLANNING WORK SHEET
NAD-GEN-5200/1 (REV. 9-66)
S/N 0195-LF-202-1101

CAD Firing
Dwarf Buoy

No.	Opturator Pressure (psi)	Reactive Force (lbs.)	Velocity-Reflective (f/s) Middle 3 inches	Velocity-Reflective (f/s) Last 3 inches	Velocity-Broken-Beam (f/s) Const. Velocity	Remarks
1	50	2000 5.0 ms	50	60	60	Opt out
2	60	2000 6.0 ms	50	62	60	Opt. Stuck w/ buoy
3	55	2000 6.0 ms	66	71		Big Bang
4	40	1550 5.0 ms	42	50	43	opt Stuck w/ buoy
5	50	1900 5.2 ms	50	62	60	opt Stuck w/ buoy
6	50	2050 7.0 ms	50	62	63	opt. Stuck w/ buoy
7	50	1900 6.0 ms	50	52	58	opt. Stuck w/ buoy
8	50	1900 6.0 ms	50	62	63	opt. Stuck w/ buoy
9	55	2100 6.3 ms	52	62	63	opt. Stuck w/ buoy
10	50	1900 5.5 ms	48	56	62	Opt. & Cushion Chase behind buoy
	50	1930 5.8			59	

U.S. GOVERNMENT PRINTING OFFICE: 1970—403-313/5220 2-1

NAV 5216/144 (REV. 8-70)
0107-LF-778-6099
DEPARTMENT OF THE NAVY

Memorandum

DATE 8 AUG 1980

FROM

TO

SUBJ Dwarf Sonobuoy SLEx test firings

ambient temp 72/78°F test firing of 5 material types using SLEx bottom firing design. 1 top firing ~~bottom firing~~ SLEx (ABS) was also test fired. Test consisted of 10 firing each. Bldg #80 was test site.

Results

Bottom firing

Matl + No.

ABS #2 — 10 Cycles No failure
NOLYL #2
HDPE #1
NYLON #2

CB #2 — Extender tube failure

Top firing

ABS-A — 10 Cycles No failure.

Note: The SLC used in test of bottom firings recorded 40 test firings without failure.

OPNAV 5216/144 (REV. 6-70)
S/N 0107-LF-778-6099
DEPARTMENT OF THE NAVY

Memorandum

DATE 8-23-80

FROM 60613

TO 6061

SUBJ TEST FIRINGS DWARF AT -65°F STARTED AT INDIANHEAD MD. NAS AND COMPLETED AT BLDG #80 NADC WARMINSTER.

STOPPAGE OF -65°F TESTS ON SLE$_X$ TOP/BOTTOM FIRING SYSTEMS. - AT NAS INDIANHEAD NECESSITATED THE COMPLETION OF THE TESTS AT NADC'S BLDG #80

MATL. TYPES	FIRED NOS INDIANHEAD	FIRED AT NADC BLDG #80	RESULTS
ABS T/F	4	6	NO FAILURE
ABS B/F	9	1	NO FAILURE
CB B/F	6	TUBE CRACKED - TEST TERMINATED	
NORYL B/F	4	6	ONE LUG AT MUZZLE END CRACKED OFF
HDPE B/F	3	7	NO FAILURE
NYLON B/F	8	2	NO FAILURE

ADDITIONAL TESTS TO BE INITIATED AT NOS INDIANHEAD

OPNAV 5216/144 (REV. 6-70)
S/N 0107-LF-778-9099

DEPARTMENT OF THE NAVY

Memorandum

DATE 9-19-80

FROM

TO

SUBJ Taped breakout-Cap test firings-3 each

(1) Ambient test firings of a SLEx bottom firing ABS extender using a lug lock SLC were conducted at Bldg #80.

(2) In order to determine the effect of taping the break-out cap as per NAVAIR-28-SSQ-500.

Results

3 firings using an ABS break-out Cap taped as per requirements was conducted.

Tape caused no problem - test conducted at ambient temp 70/76 °F.

OPNAV 5216/144 (REV. 6-70)
S/N 0107-LF-778-8099

DEPARTMENT OF THE NAVY

Memorandum

DATE: 9-19-80

FROM 60613

TO 6061

SUBJ Test firing P-3C Aircraft # 153443 of SLE$_X$ T/F - B/F - NAS Warminster/NAS Lakehurst N.J.

12 Samples of SLE$_X$ T/F-B/F - were fired from subject aircraft. In this test firing of 5 plastic material types using taped break-out caps as per NAVAIR-28-SSQ-500 was accomplished without failure

AN/S-A - 2 point strain area nozzle end [illegible]

2-19-80 [illegible]

PLANNING WORK SHEET
SND-GEN-5200/1 (REV. 9-66)
S/N 0195-LF-202-1101

15[illegible] — P3 C TEST MATRIX

MATL- CONSTRUCTION NO.
1. BREAK OUT CAP.
2- BODY SLC

BREAK OUT OVAS = ALL SLEX T/F B/P 6 EDITIONS TAPED PER REF.

MATL- CONSTRUCTION NO.	DROP No	SLEX TYPE	SLEX MATERIAL	AIRSPEED KIAS	ALT Ft.	BUOY No	SLEX No	SLC No	AIRCRAFT SLT No
1. ABS 2-CIT	1	BF	ABS-C	200	500	24	24	24	A-1
	2	TF	HYBRID	200	500				A-2
1-CIT 2-CIT	3	TF	CB-B	200	500	33	33	33	A-3
	4	TF	HYBRID	225	500	7 →			A-4
	5	TF	HYBRID	250	500	6 →			A-5
1-CIT 2-ABS	6	BF	HDPE-2	250	500	28	28	28	A-6
	7	TF	HYBRID	275	500	5 →			A-7
1-CIT 2-ABS	8	BF	NYL-1	300	500	31	31	31	A-8
1-CIT 2 ABS	9	BF	NOR-1	300	500	22	22	22	B-1
	10	TF	HYBRID	300	500	4 →			B-2
1-ABS 2-ABS	11	BF	ABS-1	325	500	26	26	26	B-3
1-CIT 2-CIT	12	TF	ABS-B	325	500	34	34	34	B-4
	13	TF	HYBRID	325	500	3 →			B-5
1-CIT 2-CIT	14	BF	NYL-2	350*		32	32	32	D-[illegible]
1-ABS 2-CIT	15	BF	HDPE-1	350*		27	27	27	D-[illegible]
1-CIT 2-CIT	16	BF	NOR-2	350*		30	30	30	D-[illegible]
1-ABS 2-ABS	17	BF	ABS-2	350*		23	23	23	C-[illegible]
1-CIT 2-CIT	18	TF	ABS-A	350*		35	35	35	C-2
	19	TF	HYBRID	350*		2 →			C-3
	20	TF	HYBRID	350*		1 →			C-3

CB - Cellulose Butyrate
HDPE - Hi Density Polyethylene
NYL - NYLON
NOR - NORYL

* LBA

9-19-80 P-3 aircraft

U.S. GOVERNMENT PRINTING OFFICE 1976— [illegible]

PLANNING WORK SHEET

NADC-81193-60

OPNAV 5216/144 (REV 6-70)
S/N 0107-LF-778-6099
DEPARTMENT OF THE NAVY

Memorandum

DATE 9-26-80

FROM 60613

TO 6061

SUBJ Test firing S-3 aircraft of SLEx T/F B/F
NAS Warminster / NAS Lakehurst N.J.

12 Samples of SLEx T/F B/F Were fired at Various airspeeds and set altitude from subject aircraft. In this test firing 5 plastic material types were discharged from the air-craft without incident.

S-3 aircraft

PLANNING WORK SHEET
NAD-GEN-5200/1 (REV. 9-66)
S/N 0195-LF-202-1101

S-3 FIRING
1- BREAKOUT CAP
2- SLC BODY

	DROP No	SLEX TYPE	SLEX MATERIAL	AIRSPEED KIAS	ALT	BUOY No.	SLEX No.	SLC No	AIRCRAFT SLT No	[illegible]
1-ABS - 2-CIT	1	BF	CB-B	250	500	44	21	1	D-1 56	1-OK
1-ABS [illegible]	2	BF	ABS-C	250	500	43	22	2	N-2 4	1-OK
	3	TF	HYBRID	250		53	8	3	J-3	
1-ABS 2-ABS	4	BF	HDPE-2	300		42	24	4	F-5 53	1- OK 2- OK
	5	TF	HYBRID	300		52	27	5	J-7	
	6	TF	HYBRID	325		51	6	6	K-2 13	
1.ABS 2-ABS	7	BF	~~NYL-1~~	~~350~~		47	27	7	N-1 8	1- OK 2- OK
1-ABS 2-ABS	8	BF	NOR-1	350		46	28	8	M-2 52	1-NO CHANGE 2-OK
	9	~~TF~~	~~HYBRID~~	350		50	5	9	G-3 29	
1-ABS 2-ABS	10	BF	ABS-1	375		45	10	10	M-1 57	1- OK 2-SHEAR LIKE [illegible]
1-ABS 2-CIT	11	TF	ABS-3	375		38	11	11	K 9	1-[illegible] STRAIN 2- OK
	12	TF	HYBRID	375		49	4	12	G-4 26	
	13	TF	HYBRID	375		48	3	13	O-2 12	
1-ABS 2-CIT	14	BF	NYL-2	LBA		37	14	14	L-2 10	1- OK 2-SHEAR LIKE [illegible]
1-ABS 2-CIT	15	BF	HDPE-1	LBA		36	15	15	H-5 45	1 OK 2 OK
1-ABS 2-ABS	16	BF	NOR-2	LBA		41	16	16	O-1 16	1- 2-OK
1-ABS 2-ABS	17	~~BF~~	~~ABS-2~~	~~LBA~~		40	17	17	L-1 14	1- OK 2-
1-ABS 2-CIT	18	TF	ABS-A	LBA		39	18	18	F-4 50	1- 2- OK
	19	TF	HYBRID	LBA		55	2	19	E-5 37	
	20	TF	HYBRID	LBA		54	1	20	H-4 42	
						EMPTY TUBE			E-4 34	
			CB-B			EMPTY TUBE			D-2 18	
			ABS-C							

U.S. GOVERNMENT PRINTING OFFICE: 1976—603-013/3271 2-1

TF = 314.6 MHz
305.8 MHz

9-26-80

S-3 aircraft

NAVAL AIR DEVELOPMENT CENTER
AIRCRAFT AND CREW SYSTEMS TECHNOLOGY DIRECTORATE
WARMINSTER, PA 18974

6061
30 SEP 1980

MEMORANDUM
From: A. D. Boyd
To: Sonobuoy Launch Container Support File

Subj: Shock Test Evaluation of Five Material Candidates for the Dwarf Sonobuoy Launcher Container Extender (from 27 Aug to 2 Sep 80)

1. The five extender materials tested were: ABS-A, Hi Density Polyethylene #1, Noryl #2, ABS #2, and Nylon #2.

2. The test system was composed of a 400 varipulse shock table, a bracket mounted S-3A sonobuoy launcher tube and transducer-strain gauge readout instrumentation.

3. The table input ranged from 12.6 Gs to 14.2 Gs for an average 13.6 Gs; the time duration ranged from 16 milliseconds to 17.5 milliseconds, for an average of 16.8 milliseconds. The low band pass was set at 300 Hz.

4. The dwarf SLCs with dummy sonobuoys and extenders weighing a total of 17 to 18 pounds were dropped 150 times per material in accordance with MIL-L-81745A(AS) Amendment 1, paragraph 3.7.5 (d). The tests were completed without incident.

OPNAV 5216/144 (REV. 6-70)
S. N. 0107-LF-778-6099

DEPARTMENT OF THE NAVY

Memorandum

DATE 10-6-80

FROM 60613

TO 6061

SUBJ Dwarf DIFAR hydromechanical test.

12 Samples of SLEX T/F S/F were test fired from a P-3 aircraft # 159928 at Key West Fla. ~~test results to be determined~~ All samples were fired from the aircraft without incident, however during off loading in Key West Fla, The wind blew down 5 cylinders and on impact with the surface the T/F CB-0 sample and the S/F Nylon #1 sample broke at the [illegible] C tube area. The remaining samples appear to be without dam

10-6-80

U.S. GOVERNMENT PRINTING OFFICE 1970—403-613/5271 2-1

DWARF DIFAR HYDROMECHANICAL TEST 7 OCT 1980 KEY WEST, FL

WORK SHEET
30/1 (REV. 9-66)
LF-202-1101

	DROP No./S/C No.	DECEL. TYPE	BUOY No.	ALTITUDE (FT. ASL)	AIRSPEED (KIAS)	LAUNCH CHUTE	SLEX No.	SLEX MATERIAL	SLEX TYPE	
10-6-80	SHALLOW DROPS									
P-3	1	RECT	P1	500	300	INT. PRESS.	1	HYBRID	TF	
AIRCRAFT #	2	FABRIC DECEL	D2	500	300	INT. PRESS.	13	ABS-A	TF	
159928										
	3	RECT	P3	200	300	INT. PRESS.	2	HYBRID	TF	
	4	FABRIC DECEL	D4	200	300	INT. PRESS.	28	NOR-1	BF	
SHOOT A-1	5	RECT	P5	150	200	EXT.	3	HYBRID	TF	
A-2	6	FABRIC DECEL	D6	150	200		4		TF	
A-3	7	RECT	P7	150	200		5		TF	
A-4	8	FABRIC DECEL	D8	150	200		6		TF	
									TF	
A-5	9	RECT	P9	1000	200		7		TF	
A-6	10	FABRIC DECEL	D10	1000	200		8	HYBRID	TF	
	DEEP DROPS									
A-7	11	RECT	P11	500	300		10	ABS-1	BF	
A-8	12	FABRIC DECEL	D12	500	300		11	ABS-B	TF	
B-1	13	RECT	P13	200	300		14	NYL-2	BF	
B-2	14	FABRIC DECEL	D14	200	300		15	HDPE-1	BF	
B-3	15	RECT	P15	150	200		16	NOR-2	BF	
B-4	16	FABRIC DECEL	D16	150	200		17	ABS-2	BF	
B-5	17	RECT	P17	1000	200		21	CB-B	BF	R 1
B-6	18	FABRIC DECEL	D18	1000	200		22	ABS-C	BF	
B-7	19	RECT	P19	1000	200		24	HDE-2	BF	
B-8	20	FABRIC DECEL	D20	1000	200	EXT.	27	NYL-1	BF	R 2

R 1 — EXTENDER TUBE BROKE [illegible] FIRING AT BREECH END

R 2 — EXTENDER TUBE BROKE (WHEN?) BREECH END.

LOAD CAMERA POD ON STATION 14 (STARBOARD)

U.S. GOVERNMENT PRINTING OFFICE 1978—603-813/5271 2-1

10-6-80

NADC Memo 6061 → 11-20/21-80

Tip-over test of SLE$_x$ -

1. All available samples of SLE$_x$ top firing and bottom firing were subjected to 20 cycles of conditions similar to flight line experiences. In the event of tip over to the unloaded SLE$_x$ on the landing strip. The samples were tipped onto a concrete floor with condition simulating the above. It is to be noted the CAD was inplaced.

Results; -

ABS T/F - 20 cycles - No effect
ABS B/F - 20 cycles - Handle seal to rod broke at 9 cycles - OK otherwise
HDPE B/F - 20 cycles - No effect
NYLON B/F - 1 cycle shattered into 3/4 sections - failed
CB T/F-B/F - Failed in previous testing.
ACRYL. - 2 samples failed 2/3 cycle at top threaded area where CAD Cap installed.

APPENDIX D

DRAWING LISTS - PRODUCTION SYSTEMS

DRAWING LISTS - PRODUCTION SYSTEMS

Top Firing SL/DSLS

AML	21961	Top Firing SL/DSLS
	21962	Extender, TF-SL/DSLS
	21963	Cushion, DSLC Header
AML	21992-1	Top Firing DSLC

Bottom Firing SL/DSLS

AML	21971	Bottom Firing SL/DSLS
	21972	Extender, BF-SL/DSLS
	21973	Header Assembly
	21974	Shielded Wire Cable Assembly
	21976	CAD Receptacle
	21977	Cushion, DSLC Header
	21978	Dual Locking Kit
	21979	Rod, Locking
	21980	Collar, Grip
	21981	Collar, Locking
	21982	Collar, Detent
275	AS109	Cap Assembly
AML	21992-2	Bottom Firing DSLC

Refurbishing Kit

AML	22007	Refurbishing Kit
	21993	Support, Breech Cushion
	21994-X	Cushion, Breech
	21995	Obturator
	21994-X	Cushion, Muzzle
	21996	Cord, 12 Inch
	21997	Breakout Cap
	21998	Lug, Shear
	MS29513-154	"O" Ring, Breakout Cap

A P P E N D I X E

TOP FIRING AND BOTTOM FIRING FIRST ARTICLE DWARF SONOBUOY LAUNCHER SYSTEMS GROUND TEST PLANS, SCHEDULED FOR IMPLEMENTATION AT NSWC, CRANE, INDIANA, DAYTON T. BROWN, STANDFORD, CONNECTICUT: NOS, INDIAN HEAD, MARYLAND AND NADC, WARMINSTER, PENNSYLVANIA

FIRST ARTICLE TEST PLAN (MODIFIED MIL-L-81745A(AS) FOR DWARF SONOBUOY LAUNCHER AND EXTENDER

EXCEPT AS NOTED "SLC" SHALL BE UNDERSTOOD TO MEAN SONOBUOY LAUNCHER AND EXTENDER

GROUP	ITEM	CONFIGURATION	TEST/EXAMINATION	PROCEDURE	REQUIREMENT
A		SLC W. Store 8 units Mark "A"	<u>Examination Group</u>		
	1		Workmanship	Check for damage and misassembly	3.11
	2		Safety	Check all exterior surfaces for sharp edges.	3.6.4, 3.10
B		SLC W. Store 8 units Mark "B"	<u>Storage Group</u>		
	1		Transportation Vibration	MIL-STD-810, Method 514.2, Procedure X, Curve AW.	3.7.2 (b) (1)
	2		Inspection Damage	Check and record: cracks, broken parts, abrasions and marks, and loose store.	
C		SLC W. Store 4 from "A" and 4 from "B" Mark "C"	<u>Arctic Group</u>		
	1		Low Storage Temperature	MIL-STD-810, Method 502.1, Cycle - 87°F and -40°F *three times*	3.7.4 (c)
	2		Cold Handling	Stabilize at -40°F and conduct each test within five minutes of removal from chamber.	3.7.3 (q)
	2a.		Tipover	Fed. Test Method STD-101, Method 5018 except that the tipovers shall impact at full length against the floor. Test to be performed with extender end on top.	3.7.3 (d)

	CONFIGURATION	TEST/EXAMINATION	PROCEDURE	REQUIREMENT
3	One each from "AC" and "BC" above	Field Removal	Without use of special tools, remove store from launcher-container. Evaluate the obviousness to accomplish, or the instructions if part of the marking. Evaluate in light of the task of removal of 80 stores to rearm an aircraft, and then several aircraft rearming each day. The task shall be rapid and easy. Do not include evaluation of what happens to the store unless caused by the launcher-container: report separately if unrelated.	3.8.13
4	Empty "AC" and "BC" SLC's from 3 above.	WVTR (Long Term Sealed Configuration)	Conduct test in accordance with 4.9.2 with long-term seals in place as shipped. On completion, set these two units aside for cold firing. Test to be performed without extender.	3.8.2
5.	SLC W. store, 3 units each "AC" and "BC"	Assembly for Use	Stabilize launcher-container temperature at -40^{o}. Prepare launcher-container for use in aircraft within 5 minutes of removal from chamber. Removal all "RED" long term seals and other protective devices on all units. Make visual check of shear lug or pin integrity. Tape breakout plate (or store) in muzzle using "tape track" (see 3.6.1(j)) on one unit each of "AC" and "BC" configuration. Screw expended CAD stabilized at $-40^{o}F$ in breech.	3.6.1(d) (j) 3.6.6 (g) 3.7.3 (g) 3.8.5
6.	One each from "AC" and "BC" above, w/o CADs.	Field removal	Same as in C.3. above.	3.8.13
7.	One each from "AC" and "BC" that were not taped, w/o CADs.	WVTR (Short term Sealed Configuration)	Same as in C.4. above.	3.8.2

GROUP	ITEM	CONFIGURATION	TEST/EXAMINATION	PROCEDURE	REQUIREMENT
C	8.	SLC W. store, 2 units ea. "AC" and "BC" W. expended CADs installed.	Aircraft Loading Shock	Stabilize launcher-container temperature at $-40^{\circ}F$. Within 5 minutes load launcher-container in test stand P-3C or S-3A unpressurized type sonobuoy launcher tube (SLT) or chute positioned at its normal angle in aircraft. The launcher-container shall be aligned, partially entered, and then slamed home in a follow-thru arm and shoulder action to duplicate the normal field practice.	3.7.3 (g) 3.7.5 (d) 3.8.7 3.6.4
	9.	One or more of above units.	Store Information in Aircraft	Check legibility of store type, channel, and setting while in the SLT in C. 8 above. Check with red lens flashlight in complete darkness as well as a clear lens flashlight. Reading distance 1 1/2 feet.	3 6.6 (b)
	10.	SLC W. store, 2 units each "AC" and "BC" W. expended CADs installed.	Altitude	*3054-ETP-1924 Temperature and Altitude*1/	3.7.5 (a) (b) 3.7.4 (c)
	11.		Vibration, Aircraft (in flight) ($-68^{\circ}F$ if test facility is available)	MIL-STD-810, Method 514.2 Procedure I, Part 1, use following in place of referenced curves: 2.5 g's 7-500 Hz, 1.5 g's 500-1000 Hz, .5 g's 1000-1500 Hz, and .25 g's 1500-2000 Hz. The fixture shall be a standard P-3C or S-3A unpressurized SLT positioned at the same angle as installed in the aircraft.	3.7.3 (g) 3.7.5 (c) 3.6.1 (d)
	12.		Shock, Arrested Landing (hard landing) (Do not use sample to calibrate drop) ($-4^{\circ}F$ if test facility is available)	Use standard P-3C or S-3A unpressurized SLT positioned at the same angle as installed in aircraft for fixture. Adjust shock table drop height to produce 13.3 g's 11 ms shock at sensor mounted on central bulkhead of sonobuoy. (Conduct 150 vertical drops for 20 pound store.	3.7.5 (d)

1/ Substitute Arctic reverse profile: $-20^{\circ}F$ for $-76^{\circ}F$, $-40^{\circ}F$ for $+86^{\circ}$ and $+68^{\circ}F$, $-65^{\circ}F$ for $+131^{\circ}$ and $+104^{\circ}F$, and $-87^{\circ}F$ for $+158^{\circ}F$

GROUP	ITEM	CONFIGURATION	TEST/EXAMINATION	PROCEDURE	REQUIREMENT
C	13.	SLC W. store, 4 units each "AC" and "BC" including those from items C4 and C8. Expended CADs removed.	Cold Firing (store launching)	WARNING: Do not touch CAD center firing contact and do not get body or head in line with either end of launcher-container. Intall live CAD in launcher-container and stabilize temperature of assembly at -68°F. Fire within five minutes from removal from chamber. WARNING: Prior to loading assembly in sonobuoy launch tube (SLT) or chute insure that test stand is grounded, and firing circuit is broken. Loader should remove and retain firing circuit component while loading and replace when clear. Load and fire. CAUTION: Launch store into impact absorbing dunage to enable its recovery for testing. Record bore exit time with one sensor at approximately the same distance used in test aircraft. Record initial external velocity by measuring elapse time that trailing edge of store passes two sensors, or other equivalent method. Record the reactive load of the launcher-container on the SLT breech during firing. The load sensors shall be supported by a rigid test stand, and the instrumentation response shall be 5000 Hz or better. The test equipment shall be equivalent to Naval Weapon Support Center, Crane drawing 77WQ001 "Sonobuoy Ballistic Test Facility". Examine and conduct bench test of store. Insure that launcher-container components did not damage store or cause premature deployment of components.	3.8.9 3.6.1 (g)
	14.	SLC w/o store and w/o launched components and W. expended CAD, 4 units ea. "AC" and "BC".	Cold Unloading and Disassembly	Unloaded immediately after firing, and remove CAD by hand.	3.8.10 3.8.11 3.6.4 3.7.3 (g)

GROUP	ITEM	CONFIGURATION	TEST/EXAMINATION	PROCEDURE	REQUIREMENT
D	1	SLC W. store, 4 from "A" and 4 from "B"	<u>Tropic Group</u> High Storage Temperature	MIL-STD-810, Method 501.1, Procedure II, cycle from +128°F to +160°F.	3.7.2 (a) 3.7.4 (c)
	2	Mark "D"	Salt Fog	MIL-STD-810, Method 509.1, position one each from A and B breech up, muzzle up, setting port up on side, no setting port up on side. Use temperature specified in MIL-STD-810. Check humidity indicator.	3.7.2 (c)
	3		Sun	MIL-STD-810, Method 505.1, Procedure II. Use values specified in MIL-STD-810.	3.7.2 (d)
	4		Rain (and washdown)	MIL-STD-810, Method 506.1, Procedure I, position same in D.2. Check humidity indicator.	3.7.4 (c), (a) 3.7.5 (f)
	5		Humidity	MIL-STD-810, Method 507.1, Procedure V	3.7.4 (c)
	6		Fungus	MIL-STD-810, Method 508.1, at option of test activity based on effectivity or test separately using an alternate sample.	3.5 (c)
	7		Hot Handling	Stabilized at +128°F and conduct each test within five minutes of removal from hot chamber.	3.7.3 (g)
	7a.		Tipover	Same as C.2.a.	3.7.3 (d)
	8.	One each from "AD" and "BD" above.	Field Removal	Same as C.3.	3.8.13
	9.	Empty "AD" and "BD" SLC's from 8 above. SLC W. store, 3 units each "AD" and "BD"	WVTR (Long Term Sealed Configuration)	Same as C.4 except the units are set aside for hot firing.	3.8.2

GROUP	ITEM	CONFIGURATION	TEST/EXAMINATION	PROCEDURE	REQUIREMENT
D	10		Assemble for Use	Same as C.5 except stabilized at +128^{O}F; tape tape track of one unit each AD and BD; and stabilize CAD at +128^{O}F.	3.6.1 (d) (j) 3.6.6 (g) (3) 3.7.3 (g) 3.8.5
	11	One each from "AD" and "BD" above, w/o CADs.	Field Removal	Same as C.3	3.8.13
	12	Empty "AD" and "BD" from 12 above.	WVTR (Short Term Sealed Configuration)	Same as C.4 except the units are set aside for hot firing.	3.8.2
	13	SLC W. store, 2 units each "AD" and "BD", W. expended CAD installed.	Aircraft Loading Shock (and) Aircraft Loading Alignment	Same as C.8 except stabilized at +128^{O}F. (and) At ambient temperature, evaluate blind loading alignment using index bar on 'breech. More than one blindfolded tester should each align all four units in mockups of pressurized P-3C chutes (rotational alignment only).	3.7.3 (g) 3.7.5 (d) 3.8.7 3.6.4 3.6.6 (g) (4)
	14	One or more of above units.	Store information in Aircraft	Same as C.9 except from D.13 above.	3.6.6 (b)
	15	SLC W. store, 2 units each "AD" and "BD" w. expended CADs installed.	Altitude	3054-ETP-1924 Temperature & Altitude	3.7.5 (a) (b) 3.7.4 (c) 3.7.3 (g)

GROUP	ITEM	CONFIGURATION	TEST/EXAMINATION	PROCEDURE	REQUIREMENT
D	16		Vibration, Aircraft (in flight)	Same as C.11 (+113°F if test facility is available).	3.7.5 (c) 3.6.1 (d)
	17		Shock, Arrested Landing (hard landing)	Same as C.12 (+113°F if test facility is available).	3.7.5 (d)
	18	SLC W. store, 4 units each "AD" and "BD", expended CADs removed.	Hot Firing (Store launching)	Same as C.13 except stabilized at +113°F.	3.8.9 3.6.1 (g) 3.7.5 (b)
	19	SLC w/o store, and w/o launched components, and w. expended CAD, 4 units each. "AD" and "BD"	Hot Unloading and Disassembly	Same as C.14	3.8.10 3.8.11 3.6.4 3.7.5 (b) 3.7.3 (g)

STATEMENT OF WORK
FOR
SHOCK TEST PROGRAM ON DWARF SONOBUOY LAUNCHER SYSTEM

1.0 INTRODUCTION

1.1 The dwarf sonobuoy is being developed under the technical cognizance of this command. A dwarf sonobuoy launcher extender and sonobuoy launch container have been designed and developed. Together these components comprise the launching assemblies that are intended for use by the fleet. Prior to introduction to the fleet, simulated catapult and arrestment tests (shock tests) must be performed.

2.0 SCOPE

2.1 Conduct one shock test program on several types of dwarf sonobuoy assemblies utilizing S-3A aircraft sonobuoy chutes. The purpose of the task is to obtain shock test data on the sonobuoy launcher systems and determine the performance of these systems in various shock modes.

3.0 APPLICABLE DOCUMENTS

Dayton T. Brown Test Report DTB 02R72-0974, 6283-1

4.0 TECHNICAL TASK

4.1 The contractor shall be supplied the following equipment to conduct the shock test on the dwarf sonobuoy launcher systems.

4.1.1 Five top firing dwarf launcher assemblies (NADC Drawing No. AML 21961), five top firing dwarf launcher (mechanical lock) extenders (NADC Drawing No. TM 21954A) with containers (NADC Drawing No. 21992A-3) and ten bottom firing launcher assemblies (NADC Drawing No. AML 21971) and ten dummy sonobuoys.

4.1.2 Four S-3A aircraft sonobuoy chutes for assembly into a P-3 aircraft fixture.

4.2 The contractor shall perform the following tasks:

4.2.1 Re-design and fabricate adapters in the modification of an existing P-3C aircraft sonobuoy chute fixture. The modification will alter this existing fixture to accept S-3A aircraft sonobuoy chutes.

4.2.2 Conduct twenty individual shock "shots" utilizing the above fixture and the Aircraft Catapult Simulator located at the contractor's facility, Ref: DTB 02R72-0974, 6283-1. The fixture shall be mounted 45 degrees from horizontal. Two accelerometers shall be utilized for this test. One accelerometer shall sense the acceleration of the aircraft simulator carriage. The second accelerometer shall sense the sonobuoy acceleration in the same direction as the carriage. The sonobuoy accelerometer shall be mounted at the axial center on the end face of the sonobuoy. The sonobuoy launcher assemblies and aircraft chutes shall be visually inspected and observations recorded before and after every group of five shots. The following schedule is applicable; Ref DTB 02872-0974, 6283-1:

Longitudinal AFT - A set of four sonobuoy launcher assemblies, with sonobuoys shall be subjected to five shots, i.e., two top firing, 1 ea, and two bottom firing launcher assemblies.
- Specification Acceleration Level on sonobuoy - 5.3 "G's". Pulse duration 650-850 milliseconds.

Longitudinal Fwd - A new set of four sonobuoy launcher assemblies with sonobuoys shall be subjected to five shots, i.e., two top firing, 1 ea, and two bottom firing launcher assemblies.
- Specification Acceleration Level on sonobuoy - 5.3 "G"s. Pulse duration 650-850 milliseconds.

Vertical Up - A third set of four sonobuoy launcher assemblies with sonobuoys shall be subjected to five shots, i.e., two top firing, 1 ea. and two bottom firing launcher assemblies.
- Specification Acceleration Level on sonobuoy - 9.4 "G's". Pulse duration 650-850 milliseconds.

Vertical Down - The fourth set of four sonobuoy launcher assemblies with sonobuoys shall be subjected to five shots, i.e., two top firing, 1 ea. and two bottom firing launcher assemblies.
- Specification Acceleration Level on sonobuoy - 9.4 "G's". Pulse duration 650-850 milliseconds.

4.2.3 Conduct five individual shock "shots" utilizing the above fixture and aircraft simulator facility. The five "shots" shall be in one direction considered most critical by NADC as a result of the initial twenty shots. The sonobuoy launcher assemblies with sonobuoys shall be the same as utilized when performing the prior set of five shots. A "best effort" attempt will be made by the contractor during this test program phase to achieve an acceleration level where the sonobuoy assemblies will inadvertently release from the installed S-3 aircraft sonobuoy chute. All acceleration data shall be recorded.

4.3 When reporting tests conditions and results utilize NADC Drawing Nos. to identify test samples (para. 4.1.1).

5.0 DELIVERABLES

5.1 Testing shall be completed 45 days after receipt of dwarf launcher assemblies (para. 4.1.1)

5.2 S3-A launcher chutes and dwarf launcher assemblies shall be returned to NADC 60 days after test completion.

5.3 A complete engineering report will be submitted at the completion of the test program as denoted on the attached DD Form 1423.

6.0 SPECIAL CONSIDERATIONS

6.1 The NADC contact will be notified as to the test schedule in anticipation of NADC personnel being present at that time.

6.2 The technical point of contact at Naval Air Development Center regarding this program will be Mr. D. Agnew (215-441-2475), Code 6061.

6.3 The S-3A aircraft sonobuoy chutes, see 4.1.2, will be available for pick-up, see 6.2, any time after award of contract.

6.4 The contractor will be notified, see 6.2, when the launcher assemblies and dummy sonobuoys, see 4.1.1, are available for pick-up, approximately 15 Aug 1981.

NOS, INDIAN HEAD, MARYLAND

FIRST ARTICLE GROUND TEST PLAN

1. Three first article samples of each system design (TF-S2/DSLS, TF-SL/DSLS with mechanical lock and BF-SL/DSLS) are to be delivered to NOS by 1 September 1981; two first article samples of each system design for testing; one for back-up.

2. The two first article test samples of each system design will be ground fired thirty-three times each, after "cold soak" at -65 $\pm$ 2°F for three hours. For two first article test samples of each of the three system designs, a total of 198 ground firings will be implemented, each firing required within five minutes after removal from the "cold soak" chamber.

3. The six-first article test samples that successfully endure "cold soak" ground firing, will then be ground fired after "hot soak" at +160 $\pm$ 2°F thirty three times each, for a total of 198 firings. As in the case of the "cold soak" ground firing tests, "hot soak" ground firings are to be implemented within five minutes after removal from the "hot soak" chamber.

4. The 396 ground firings (198 "cold soak"/198 "hot soak") at NOS are scheduled for completion by 18 September at which time all first article samples will be picked up for return to NADC for ambient ground firings, in accordance with Appendix E. A technical report on the "cold soak" and "hot soak" ground firing test results by NOS is planned for delivery to NADC thirty days after completion of the subject effort, 18 October.

TEST PLAN (MODIFIED MIL-L-81745A(AS)) FOR ARRESTED LANDING SHOCK OF TF, BF AND TF WITH ADAPTER EXTENDERS AND DWARF

SONOBUOY LAUNCHER CONTAINERS

GROUP	ITEM	CONFIGURATION	TEST/EXAMINATION	PROCEDURE	REQUIREMENT
A	1	2 ea. of 3 types with expended CADS installed	Arrested Landing Shock (hard landing)	The test system to be composed of a varipulse 400 shock table, a bracket mounted S-3a sonobuoy launcher tube (SLT) and transducer-strain gauge read out instrumentation. The S-3a SLT to be positioned at the same angle as installed in aircraft. Adjust shock table drop height to produce avg. 13.3 G's, 16-18 MS shock at sensor mounted on center bolthead of sonobuoy. Conduct 150 vertical drops for store of this weight.	3.7.5(d)

TEST PLAN (MODIFIED MIL-L-81745A(AS)) FOR INSTRUMENTED AMBIENT TEMPERATURE FIRINGS OF TF,

BF AND TF WITH ADAPTER EXTENDERS AND DWARF SONOBUOY LAUNCHER CONTAINERS

GROUP	ITEM	CONFIGURATION	TEST/EXAMINATION	PROCEDURE	REQUIREMENT
A	1	2 ea. of 3 types with CAD installed	Ambient firing (Min. 3 hr. soak) repeat with each 134 times for a total of 804 firings.	WARNING: do not touch CAD center firing contact and do not get body or head in line with either end of launcher-container. Install live CAD in launcher-container and stabilize temperature of assembly at -68^{o}F. Fire within five minutes from removal from chamber. WARNING: prior to loading assembly in sonobuoy launch tube (SLT) or chute insure that test stand is grounded, and firing circuit is broken. Loader should remove and retain firing circuit component while loading and replace when clear. Load and fire. CAUTION: launch store into impact absorbing dunage to enable its recovery for testing. Record bore exit time with one sensor at approximately the same distance used in test aircraft. Record initial external velocity by measuring elapse time that trailing edge of store passes two sensors, or other equivalent method. Record the reactive load of the launcher-container on the SLT breech during firing. The load sensors shall be supported by a rigid test stand, and the instrumentation response shall be 5000 Hz or better. The test equipment shall be equivalent to Naval Weapon Support Center, Crane drawing 77WQ001 "Sonobuoy Ballistic Test Facility". Examine and conduct bench test of store. Insure that launcher-container components did not damage store or cause premature deployment of components.	3.8.9 3.6.1(g) 3.7.5(b)

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